An Assessment of Private Salmon Ranching in Oregon

Funded by the
Oregon Department of Fish and Wildlife

Prepared for the
Oregon Coastal Zone Management Association, Inc.
Newport, Oregon

Prepared by
The Mayo Associates
Natural Resource Planners
108 South Washington
Suite 204
Seattle, WA 98104

November 30, 1988

An Assessment of Private Salmon Ranching in Oregon

Funded by the
Oregon Department of Fish and Wildlife

Prepared for the
Oregon Coastal Zone Management Association, Inc.
Newport, Oregon

Prepared by
The Mayo Associates
Natural Resource Planners
108 South Washington
Suite 204
Seattle, WA 98104

November 30, 1988

THE MAYO ASSOCIATES
Suite 204 - 108 S. Washington St.
Seattle, WA 98104
(206) 223-1551
Cable: MAYO

November 30, 1988

Jay Rasmussen
Director
Oregon Coastal Zone Management Association
PO Box 1033
Newport, Oregon 97365

Subject: An Assessment of Private Salmon Ranching in Oregon

Dear Jay,

This is to transmit 100 copies of this assessment. This completes our services on this assignment.

We can say, without fear of contradiction, that this has been one of the more interesting studies we have undertaken. Working with you, your staff and the Advisory Committee has been a real pleasure. A special thanks to all.

A special thanks also to the Oregon Department of Fish and Wildlife and the Private Salmon Ranching Industry. Though, it appears that their relationship has troubled moments, we should not lose sight of what they have accomplished together. No other state has had the courage to undertake such a experiment in technical and institutional cooperation.

Respectfully submitted,

Ronald D. Mayo
The Mayo Associates

Table of Contents

Study Participants

The following is a partial list of individuals who participated in this assessment either as part of the Advisory Committee, through interviews and/or by receiving partial drafts. The names with an * participated in Advisory Committee activities. Names with ** participated in the opinion questionnaire decribed in Part 4. While they are not responsible for the content of this study, their help in its preparation is gratefully acknowledged.

Bakke, Bill - Oregon Trout, Portland, Oregon* **
Barth, Don - Yaquina Bay Bank, Newport, Oregon*
Becker, Mike - Troller, Newport, Oregon **
Becker, Tom - Oregon Salmon Development, Newport, Oregon **
Berg, Roger A. - OCZMA Board**
Berry, Rick - Oregon Dept. of Fish & Wildlife, Portland, Oregon **
Boley, Scott - Troller, Gold Beach, Oregon **
Bowden, Roy - Northwest Steelheaders, Gaston, Oregon
Bradbury, Bill - Oregon State Senate, Bandon, Oregon
Bradshaw, Bill - Harbormaster, Winchester Bay, Oregon
Brenneman, John - Oregon State Senate, Newport, Oregon **
Butsch, Don - Oregon House of Representatives, Newport, Oregon
Christenson, Don - Oregon Guides & Packers, Newport, Oregon
Creasy, Gerald - Commissioner, Tillamook, Oregon **
Cummings, Ed - Oregon Dept. of Fish & Wildlife, Portland, Oregon* **
Dalziel, C. Joanne - OCZMA Board**
Dukes, Joan - Oregon State Senate, Astoria, Oregon
Duncan, Devin - Oregon Council, Federation of Fly Fishers, Salem, Oregon **
Edmunds, Basil - Oregon Economic Development Dept. Tillamook, Oregon
Elliot, Arlo - American Sport Fish Alliance, Portland, Oregon
Emlen, John - NFR Center, Seattle, Washington **
Feldner, Jeff - Troller, Logsden, Oregon
Ganzaom, Jack - Ocean Ranching **
Garrison, Bob - Oregon Dept. of Fish & Wildlife, Corvallis, Oregon **
Gowan, Ron - Anadromous Inc., Corvallis, Oregon*
Hamilton, Dr. J. Roy - OSU, Beaverton, Oregon
Hanlon, Tom - Oregon House of Representatives, Cannon Beach, Oregon
Hanneman, Paul - Oregon House of Representatives, Cloversdale, Oregon
Heikkila, Paul - Marine Extension Agent, Coquille, Oregon **
Horton, Dr. Howard - OSU, Corvallis, Oregon **
Jackets, Jeff - OCZMA Board**
Johnson, Jim - Independent Troll Fishermen of Oregon, Charleston, Oregon* **
Kitzhaber, John - Oregon State Senate, Roseburg, Oregon
Koo, Buck - Brockings, Oregon
Korpela, Eldon - STEP, Astoria, Oregon **
Labhart, Mark - STEP, Tillamook, Oregon **
Lannan, Dr. Jim - Hatfield Marine Science Center, Newport, Oregon **
Lewis, Ernie - Oregon Salmon Development, Portland, Oregon*
Liss, Dr. William - Fish & Wildlife OSU, Corvallis, Oregon
Martin, Jim - Oregon Dept. of Fish & Wildlife, Portland, Oregon
McIntyre, Jack - US Fish and Wildlife Service
McMillin , Norma - OCZMA Board**
McNeil, Dr. Bill - Hatfield Marine Science Center, Newport, Oregon **
McTeague, Dave - Oregon House of Representatives, Milwaukee, Oregon
Meuret, Forrest - Oregon Wildlife Federation, Madras, Oregon
Mohr John - OCZMA Board**
Moser, Gerald - OCZMA Board**
Nicholas, Jay - Oregon Dept. of Fish & Wildlife, Corvallis, Oregon
Phillips, Ron - Newport-Pacific Corportation, Newport, Oregon* **
Pullen, Bob - Former charterboat operator, Charleston, Oregon* **

Radtke, Hans Ph.D. - Agricultural & Resource Economist, Yachats, Oregon
Rasmussen , Jay - OZCMA Executive Director**
Robinson, Tom - Oregon Salmon Commission, Newport, Oregon*
Robison, Fred - OCZMA Board**
Rompa, Bill - Oregon Dept. of Agriculture, Salem, Oregon
Ross, Gordon - OCZMA Board**
Schlip, Dave - Troller, Pacific City, Oregon **
Schreck, Dr. Carl - Oregon Coop Fishery Research Unit, OSU, Corvallis, Oregon
Schroeder, Walt - Oregon House of Representatives, Gold Beach, Oregon **
Severson, Dick - Oregon Aqua-Foods, Springfield, Oregon* **
Smith, Blanchard - Assc. of Northwest Steelheaders, Lincoln City, Oregon* **
Smith, George K - OCZMA Board**
Smrekar, Jack - Troller, Florence, Oregon
Sowa, Larry - Oregon House of Representatives, Oregon City, Oregon
Strycker, Warren - Oregon Coast Association, Newport, Oregon
Stuart, Harry - Oregon Wildlife Federation, McMinnville, Oregon* **
Tate, Jim - Depoe Bay Charterboat Association, Depoe Bay, Oregon **
Ternyik, Wilbur - Mayor, Florence, Oregon
Tobolski, Jeff - Fisheries Consultant, Lake Oswego, Oregon **
Ulright, Eldon - OCZMA Board**
Voss, Chuck - American Sportfishing Alliance, Tigard, Oregon
Wagner, Harry - Oregon Dept. of Fish & Wildlife, Portland, Oregon* **
Warrens, Frank - Oregon Charterboat Association, Portland, Oregon **
Whitty, Jim - Oregon House of Representatives, Coos Bay, Oregon
Wilkinson, Keith - Troller, Brookings, Oregon **
Williams, Carla - OCZMA Board**
Zirges, Malcom - Oregon Dept. of Fish & Wildlife, Newport, Oregon

Summary and Analysis

This Report

This report was authorized by the Oregon Coastal Zone Management Association in June, 1988 and funded by the Oregon Department Fish and Wildlife. It was carried out by The Mayo Associates of Seattle with advice from an advisory committee appointed by OCZMA.

The focus of this assessment is:

> On providing a history of the private ocean ranching of salmon in the state of Oregon in the context of public and private salmon ranching and farming throughout the world,
>
> On a discussion of the issues of special concern to private ocean ranching,
>
> On the current status of Private Ocean Ranching in terms of its chances for survival, and
>
> On the factors that might influence future choices for Oregon's private ocean ranching.

No attempt is made to decide if private ocean ranching is good or bad. That decision is one of individual choice. However, information is presented to suggest ocean ranching can be encouraged (or discouraged) once a decision is made.

Background

Ocean ranching in this context is the release and later harvest of salmon. It has been practiced over much of the temperate world for over a 100 years with some of the first private salmon hatcheries being constructed in Oregon in the 1870's. It has been a part of the successful transplanting of salmon to New Zealand, Chile and the Great Lakes. Public hatcheries have been a common feature in the Columbia Basin for 50 years where they were constructed to mitigate damage from dam construction. Though these and other mitigation efforts were not generally successful in the 1940's and 1950's, technical advances in the 1960's provided enough good examples to bring public ocean ranching into public favor.

In the late '60's and early '70's a number of enthusiasts began to visualize the possibilities of private ocean ranching as a commercial undertaking. The availability of salmon propagation technology being developed by state and federal agencies and a common perception that private industry could do it better, encouraged investors in nearly every temperate country to "think salmon".

The four western states each took on the issue of "Should private salmon ranching be permitted and if so, under what conditions?" and each took a different direction:

> **Alaska** bought the concept and put fisherman owned, private non-profit (PNP) cooperatives in control. A number of facilities have been built from harvest taxes. Their program appears to be successful and expanding.
>
> **California** passed a law allowing private ocean ranching and then issued only one permit. The returns are minimal and private ocean ranching is not considered a success.
>
> **Washington** refused the concept, except for several small, non-profit efforts. Attempts to change the legislative mind have failed and salmon pens and tank farms appear to be the form of the future, siting issues notwithstanding.

Oregon, in the early 1970's, passed laws to make private ocean ranching possible and became America's testing grounds for the concept. In four short years (1974/8) twelve permits were issued and significant construction undertaken. In 1977, Crown Zellerbach (C-Z) made application and the same issues that defined the legislative debates were reargued, but this time, the courts made the decision and the C-Z application was rejected. It is generally, considered that this reversal resulted in the current moratorium on new and/or expanded permits.

Other salmon programs continue to develop in other parts of the world and the successes, especially in Japan, where hatchery production contributes approximately 50 million salmon per year to the harvest, continue to fuel interest in ocean ranching. Today there is no major salmon program that does not rely, to some degree, on hatcheries.

This includes Oregon where, as a example, 85% of the coastal coho harvests is based on hatchery production, with the private hatcheries contributing about 16% of that amount. This contribution is not however, universally appreciated and the course of private ocean ranching has not been smooth. For example:

In 1983 the Burnt Hill Salmon Ranch, Inc owners turned the facility over to the creditors. It was sold to the high bidder, Ocean-Pacific Salmon Ranch.

In 1983 Domsea made their last releases in Siuslaw Bay.

In 1983/84 "El Nino", an ocean condition widely blamed for low salmon returns, was at its "worst". Total survival (harvest and escapement) in these years from private coho plants averaged below 1%.

In 1985 the returns of private hatchery chum salmon were at a peak, 3,220 fish. This return of approximately 0.12% effectively ended significant interest in chum salmon.

In 1985 the Weyerhaeuser Company, Oregon Aqua-Foods owners, announced their desire to sell the company.

In 1985 legislation was introduced to require tagging of all privately released fish. Though it did not pass, it was considered generally representative of legislation unfriendly to private ocean ranching that is introduced most years.

In 1987 Governor Goldschmidt vetoed legislation that would have made the purchase and operation of Oregon Aqua-Foods by a state sponsored non-profit organization possible. The veto message , however, focuses on a need to not split the management of the salmon resource and the "excessive" fee that would be charged the commercial fishermen. The effect was to put a "public" solution on the back burner and leave the field to private investors.

In 1987, as a result of concerns over perceived impacts on natural stocks in the Yaquina River, ODFW reviewed Oregon Aqua-Foods' coho operations and directed series of actions to provide data on impacts and the control of impacts.

In June, 1988 the Weyerhaeuser Company announced plans to sell Oregon Aqua-Foods to Oregon Salmon Development, Inc., a private group. In October, 1988 the stock offering to finance this sale was withdrawn by underwriters who cited the "arbitrary nature of (ODFW commission) decisions which fundamentally alter the future prospects for (private) salmon ranching." This referred to a commission action in the Coos drainage which was, at best, an example of poor communication between the commission, the local advisory committee, the ODFW staff, and the ocean ranchers.

Status

Today there are 12 permitted Private Salmon Hatcheries in the state. However, with all due credit to the rest of the permittees in the state, Oregon private ocean ranching consists of only three substantial operations:

Anadromous, which has release sites at Coos Bay and a freshwater rearing facility near Fort Klamath. In 1988 this group planned to release 1.2 million coho and 1.075 million spring chinook. The 1988 release numbers are an 80% decrease from the prior year for chinook and a more than double for coho. The 1989 plans are not yet set but they indicate that recent commission action has caused them to drop all plans for a 1989 release of chinook salmon. Operations started in 1974 by private investors but control has since been purchased by British Petroleum-North America. The present management indicates that they expect to be marginally profitable soon but that their concern over regulatory and harvest issues together with other issues related to parent company interest is causing them to direct their attention to other aspects of aquaculture.

Oregon Aqua-Foods, which has a release site at Newport and a freshwater rearing site at Springfield. In 1988 this group planned to release 3.8 million coho and 2.3 million chinook, mainly Rogue River Spring Chinook, RRSC. These release numbers are a small decrease from the prior year. Ocean ranching operations started in 1974 and in 1975 the company was purchased by the the Weyerhaeuser Company. In 1985 the present owners announced a desire to sell the company. This desire to sell grows in part from changing corporate objectives but it also reflects concerns over state regulatory actions. The present management indicates that they are approaching profitability but that this is due to a broadening of their sales of smolts, pan sized fish and eggs rather than from ocean ranching. In 1987, the sale of harvested fish from ocean ranching was only 20% of the total income.

Oregon-Pacific Salmon Ranch, which has a release site on Burnt Hill Creek south of Gold Beach and an inland fresh water rearing site nearby. In 1988, this group planned to release 850,000 chinook (RRSC). This release number is a small increase over the prior two years. Operations started in 1980 but the original owners were unable to continue operation in 1983 and the assets were sold to Oregon Pacific, Inc. The present owners indicate that they are marginally profitable but that they are interested in new investors.

A fourth operation that could have significance is the **Domsea** facility at Siuslaw Bay. Its largest releases were about 800,000 chinook and coho in 1979. It is in a location considered by some to be a good one and has a relatively large freshwater supply at the release site. Releases stopped in 1983, after a period of disappointing returns and the facilities have deteriorated a great deal.

Thus, the above three operating facilities, planned to release just under 6 million chinook and 5.2 million coho in 1988. The permits of the above four operations would allow annual releases of over 32 million coho and 37 million chinook. Thus current release levels are a relatively small part of the nominal authorization. Still, even at this level, private hatcheries contributed 147,000 coho and 45,000 chinook to the average annual public harvest in the 1985-87 period.

In general terms, the fish propagation technology and the applied research that is a part of private ocean ranching is somewhat ahead of that at ODFW hatcheries. This is a relatively recent event and is a product of the more focused incentives of private industry which have been applied to a foundation that was supplied, in large measure, by ODFW. By and large, ODFW is well acquainted with the private technology and, where funding allows, are adopting elements of it.

Statutes and Regulations

The statutes and regulations which control private ocean ranching are numerous and complex. Their impact on the industry is significant without a doubt inhibiting. Views as to whether this inhibition is justifiable vary a great deal with the ODFW opinion being expressed in these words:

> "To prospective salmon ranchers, the variety and detail of the regulations, permits, and licenses to which a salmon ranch is subject may seem an insurmountable barrier. Moreover, there can be little doubt that the complexity of the regulatory process itself is somewhat of a constraint on the industry's development. This is not necessarily an improper or unnecessary situation. Salmon ranching is a complex proposition that affects coastal and fishery resources and may potentially affect commercial and recreational salmon fishing in unknown ways. The number of regulations which surround ocean ranching, in large measure, reflects public concern about the values and resources which are potentially affected. These are legitimate and important public concerns."

Issues

There are a number of issues which were considered as part of this assessment of private ocean ranching. As each issue was considered a consensus response was arrived at representing a reasonable combination of views of the those involved in the preparation of this analysis, the advisory committee and others whose views were sought out. The more important of these issues and the proposed consensus responses were:

Relative Fishery Contribution and its Determination- Coho - The private hatcheries are making a significant contribution to coho harvest and that contribution is generally increasing. These contributions are generally welcomed, even if not at full "face value".
The naturally spawning coho are contributing about the same today as the private hatcheries but their contribution is well down from the past. The public hatcheries are contributing about 65% of the harvest today but their contribution is also well down from the past. While harvests are declining, escapements appear to be fairly constant. The impact of hatcheries on natural production is of concern to some.

Fishery Contribution - Chinook- It is clear that "private" chinook have made a contribution to the Oregon fishery with the potential to exceed the coho contribution. As the use of the Rogue River Spring Chinook is a new undertaking in the two larger hatcheries, its impact is not yet clear. The impact of hatcheries on natural production is of concern to some.

Market Competition - Private Salmon - On a world scale (or even within the US), private salmon ranching in Oregon is not a significant determinate of the price of salmon. At a local level there may be minor impacts but these could be mitigated by better total local harvest. The use of Rogue River Spring Chinook by private growers may have some impact the commercial fisherman's market for early harvest chinook. This is viewed by some as being of benefit to the consumer and the state economy. Options for minimizing the impact on the trollers may be available.

Attitudes of Oregon's Salmon Fishing Industry to Private Salmon Ranching Initially and Today.- This has no clearly defined consensus with the views ranging from:

> Both the commercial and recreational sectors of Oregon's salmon fishing industry now strongly support private salmon ranching. This is in contrast with their earlier view.
>
> to
>
> Both the commercial and recreational sectors of Oregon's salmon fishing industry now strongly oppose private salmon ranching. This is similar to their earlier view.

Harvest Management as a Means to Insure a Specific Public/Private Harvest Split- The chances for the survival of private ocean ranching would be improved by a clearly enunciated policy for harvest management that would provide the growers with a consistent and adequate share of the returning fish of private origin. ODFW has the capability to approach, as a long term average, some specific public/private division objective. The propriety of such action is a separate question.

The "Fair Rent" Concept- The Fair Rent Concept, offers an opportunity to improve the stability of private salmon ranching and increase its contribution to the ocean fishery. However, the challenge of expanding the concept into a quantified and enforceable agreement that will find adequate acceptance is a major one. Success is not insured by agreement in concept.

Free Market/Full Ownership Concept - A Free Market/Full Ownership Concept could be a viable method for providing stability to private salmon ranching and it is, at least in theory, a better approach than a "fair rent" system based on special interest negotiations. However, this may be too small a problem to be solved by so large a change in public policy. Still, as our present systems for distribution of this resource is satisfying few and providing little effective protection, a look at alternatives in this direction is easily justified.

Carrying Capacity - Release Strategies have eliminated much of the concern over river carrying capacity as relates to smolts. (The straying of adults into the rivers is a different issue.) Concerns for the ocean's carrying capacity should be small except at maximum levels of release. As the maximum scenario is approached caution may be appropriate but only within the framework of all of the North Pacific Salmon Programs.

Genetic Implications of Private Salmon Ranching in Oregon - The genetic implications of private salmon ranching in Oregon can, at best, be seen only dimly and it is unlikely that a clearer vision will be available in the short-term. While caution is reasonably advised at this point, even the meaning of caution is unclear. There is general agreement that the genetic implications of harvest management are more profound than the genetic implications of hatchery management. In general, the private ocean ranching would appear to carry no greater risk than any other hatchery program in the state assuming the same number of fish are produced.

On review by others involved in these issues the above discussion was generally accepted but with a number of reservations to suggest that practices in both ODFW and the private facilities are more sensitive to genetic impact concerns than is generally appreciated by those not involved in the operation of the hatchery facilities. Conclusions are drawn and decisions made that are based on genetic understanding and implications.

The Straying of Returning Adults - The private hatchery fish will stray from their acclimatization sites as will all salmon stocks. However, evidence suggest that straying may be greater from some release strategies and thus should be of special concern. Improved release strategies should improve past performance but at, perhaps, some cost. Quantification of the degree of straying would be useful in defining damages but at this time sufficient hard data is not available. Damages or benefits may accrue from straying and they are best defined on a case by case basis.

Private Salmon Ranching and the State's Wild Fish Policies - The state's wild fish policies have the potential for providing stability to the private hatcheries operations but this has not been very effective in practice. These same policies have shifted reflecting changing views by the legislature and ODFW.

An Economic Comparison of Scenarios -

To provide a foundation for an economic comparison of different "future" a series of 5 near-term scenarios were defined that reflect the probable range of where Oregon's private ocean ranch will be by the year 2000. These scenarios are:

1. **Closure** - This assumes closure of all operations, Ore Aqua Foods, Anadromous, Oregon Pacific, Domsea.

2. **Limited Operations** This assumes operation of Ore Aqua Foods, Anadromous, Oregon Pacific but only at reduced level as may be related to providing stock for salmon farming and egg sale. Total release levels: chinook=3.8 million, coho=1.0 million.

3. **Status Quo** - This assumes operation of Ore Aqua Foods, Anadromous, Oregon Pacific but only present levels. Total release levels: chinook=8.0 million, coho=5.0 million.

4. **Expanded Operations** - This assumes operation of Ore Aqua Foods, Anadromous, Oregon Pacific and Domsea but only at partial permit levels. Total release levels: chinook=20.0 million, coho=18.0 million.

5. **Maximum Operations** - This assumes operation of Ore Aqua Foods, Anadromous, Oregon Pacific and Domsea at full permit operations at all sites. Total release levels: chinook=37.0 million, coho=32.8 million.

Scenarios involving higher levels of production were not considered.

Based on criteria developed here and these scenarios, the economic impact on the state of the coastal salmon fishery for the "Maximum" Scenario is over $81 million as compared to a $35 million impact of fishing under the "Closure" scenario. Thus the increase attributed to "private" fish is $46 million for the maximum scenario. Straying losses are small compared to this gain.

Another basis for comparing scenarios is in terms of the total number of fish publically harvested. The gain, as compared to "closure", of the "Maximum" Scenario is is about 740,000 fish and the maximum straying loss is approximately 37,000 fish. Thus the "Gain/Loss" ratio is about 20:1.

Variations in Private Production - To ask private ranchers to make their production programs significantly more stable than those defined by their permits will require that their economic benefit be a positive one or that there be some other operating trade-off.

ODFW's Policy on the Support of Private Salmon Ranching - A clearly stated, and effectively communicated, ODFW policy defining its level of support for of the concept of private salmon ranching would improve the Department's consistency in dealing with issues and developing regulations. A clearly stated, and effectively communicated, ODFW policy in support of the concept would improve private salmon ranching's ability to develop financial support.

The Cost of Replacing Production Capacity - Assuming the assumption made are valid, the public investment required to replace the current contribution of the private ocean ranchers is currently on the order of $2 million per year. The annual investment required to reach harvests equivalent to any of the expanded scenarios is in excess of $6 million.

Factors in the Choice of Scenarios

The ultimate choice of a "future" scenario will be based on the general perceptions of the issues previously discussed and a series of other factors that were developed here as follows:

Public Support for Private Salmon Ranching - This was tested by a questionnaire sent to 67 people including the advisory committee for this study, a list of individual that we had been asked to interview and a number of OCZMA board members. The overall response to the questionnaire was about 65%. Based on this questionnaire we learned:

a. It would appear that there is general support for some expansion of Private Salmon Ranching and that views are related to each individuals role. Typically, the fishermen are a little less enthusiastic and the ocean ranchers are more. About 83% of the responses were in support of ocean ranching "At or Above" present levels or more. Few are willing to take extreme positions. (i.e. "Close All" or "No Limits".)

b. The social goals considered in this analysis were ranked in this order (high to low) by those who received the questionnaire:

1. Expand Benefits - To expand the economic benefits of the coastal salmon resource - because there is a need to improve the economic base of the coastal communities and the State of Oregon.

2. Maintain Benefits - To provide at least a continuation of past levels of fishing opportunity to sports and commercial fishermen - because this diversity of types of livelihood and recreation is socially desirable.

3. Natural Production - To protect the natural production of salmon in the coastal rivers - because this production costs little and because this activity supports other social goals including the preservation of these rivers in their natural state.

4. Genetic Integrity - To protect the genetic integrity of wild salmon populations from further compromise - because these fish may have special value in a number of ways especially in the future health of the salmon resource.

5. Oregon Control - To keep control of the fishery resource with the State of Oregon - because such control is the best device we now know to provide long term protection of the resource.

6. Taxpayer Cost - To minimize cost to the taxpayers - because this is what the taxpayer wants.

7. Consumer Interest - To protect the interest of the consumer who buys these fish by fair prices and good quality - because the fishery resource should not be developed only to benefit the fishermen or the salmon or the rivers or the private salmon ranchers.

8. Privatization - To benefit from the special resources of private industry - because there are some things they do better than bureaucratic institutions.

9. Jobs - To provide jobs whose content is of interest to people in Oregon - because to some an interesting job is more important than a high paying job and to support this philosophy in some is socially desirable.

10. Investment - To provide investment opportunities to the citizens - because ours is a free enterprise system.

c. That quantification of the above social goals can be viewed as supporting the conclusion that there is support for some expansion of ocean ranching.

ODFW Policy - ODFW has little in the way of formal policy supporting private Salmon Ranching. However, that does not mean that their policies will not impact the which scenario the future will bring. It would appear to us that ODFW actions that would effectively favor private salmon ranching's expansion would be:

1. A policy statement, supported by actions, defining ODFW's long term support of private salmon ranching as a concept.

2. The development of a "Propagation and Harvest" program that would effectively integrate private ocean ranching and the state's programs. Such a program might include:

a. Management, and other, trade-offs for production level guarantees from the private salmon ranchers.

b. A policy that quantifies acceptable straying at levels that are realistic both as percentages and as total numbers.

c. Long term release approval commitments from the state so as to avoid annual renegotiations.

d. Research programs providing a balanced evaluation of problems common to state and private facilities such as stock selection, straying, survival rates, and genetic impacts.

e. Research into the decline of coastal rivers in salmon production.

3. An increased sensitivity, by ODFW, of the impacts of their regulatory actions on the economics of the industry, especially as typified by the Coos Basin Plan decision.

Nature's Impact Man can do many things to direct success in ocean ranching but in the end nature will decide what each season will bring and in the choice of scenarios for the future. . However, there are responses that man can make that would favor expanded private salmon ranching. They are:

1. A better understanding of the factors, especially upwelling conditions, that can improve adult survival for private salmon as compared to natural salmon in any given year.

2. Better harvest management to reduce the variation in Private/Public harvest levels that occur in part because of varying distribution of stocks.

3. A willingness of investors to provide economic support to private salmon ranching in poor years and to establish reserves in good years.

4. A willingness of private ranchers to diversify, as some are now doing.

Concern for Natural Production - This is frequently at the heart of disagreements over private salmon ranching both in terms of genetic impacts and straying impacts.

In terms of the genetic issue, we can say little more than was said in the discussion of that issue. It is hard to quantify and hard to find agreement. However, genetic impact concerns would tend to mitigate towards less private salmon ranching.

The straying impacts on natural production would appear to be better suited to quantification. To do this a series of assumptions were made in this study. If these assumptions are valid the impact of stray losses is offset by at least 20 to 1 by private hatchery production. On this basis, this concern would tend to mitigate towards more private salmon ranching.

Economic Agreements - Various state/private economic agreements are discussed that could improve the chances for the expansion of private salmon ranching. These include elements of the "Fair Rent" concept and the "Free Market/Full Ownership" concept. These may not have practical significance to the selection of a scenario for private salmon ranching in that:

1. The "Fair Rent" concept will require adoption of specific harvest values and compensation that many will find impossible because of the difficulty of defining what the appropriate "numbers" are.

2. The "Free Market/Full Ownership" concept will require changes in public policy that are so fundamental and that have such implications at all levels of fishery resources management as to make their realization in the next 12 years beyond expectation.

Other economic agreements that may benefit private salmon ranching such as the state purchase of fish for release as part of their programs have more potential if policy matters could be settled and if

both the state and the private ranchers could take a long term view. Recent efforts however, in this area were not successful.

Thus it would seem that the possibility reaching economic agreements to favor any particular scenario is not likely without major changes in public policy.

Return on Investment and the Perception of Risks - Separate from many of the issues discussed elsewhere in this assessment, is the question of the profitability and the normal business risk of private salmon ranching. These are clearly factors in the selection of a scenario. However, it is also clearly beyond this assessment to pass judgement on the potential for profit or the magnitude of risk. All we can say is this. Conditions which mitigate towards a reduction of risk and good economic returns also mitigate towards expansion of ocean ranching. However, they do no guarantee it.

Harvest Management - The way that ODFW manages the harvest is of continuing concern by all involved in this question and it has been stated that somehow the private ocean ranching is making the problem worse. We have seen little evidence that this is the case though we have heard considerable apprehension of what might happen in the future. In many ways it would appear that this is an issue that is neutral on the question of "Less" versus "More" in private ocean ranching. On one hand is apprehension over future actions and on the other is more fish available for harvest under certain management scenarios.

The Assessment

We have made no choice of scenarios. Where this goes in the future depends on what scenario people want to support and then on how willing they are to support that choice with action. However, we would like to summarize our assessment of where ocean ranching is today in the State of Oregon.

We have heard it said that over $80 million dollars has been invested in private ocean ranching in Oregon in the last 15 years and we do not doubt the estimates. As a result there have been a number of technical successes and much has been learned. More important, as a result of these investments, there is significant public support for private ocean ranching from those who believe it is, on balance, good for the state and especially good for the coastal communities. This is supported by most of the issues and factors considered in this assessment.

Even the detractors, taken as a group, are probably more supportive than they were in the past and there are few that are informed on the issues that will seriously propose that all private ocean ranching operations be closed as a matter of public policy.

Yet closure is well within the realm of possibility. It can be argued, though not yet proven, that the basic economics make this inevitable but there is little question that improved state support is a factor in the balance between continuation or failure.

The form that this support might take is suggested above in simplistic terms in the discussion of "ODFW Policy" in Part 4 but, unfortunately, this is not a simple, one-shot, solution that can or will be imposed by ODFW. Survival of private ocean ranching in Oregon also requires an improved level of support, effectively demonstrated, from legislators, the governor, businesses, local officials, private citizens, and anyone else who wants it to continue. Even with such support, survival may not be possible but for them to let failure occur without trying would be irresponsible.

This is not to say that the private ocean ranchers have always performed in ways that invite support. Early expectations, still unfulfilled, continue to be put forth by a few as certainties. Public criticism of ODFW fish propagation operations, growing out of competitive instincts rather that reasonable expectations, has created unnecessary antagonism that does not contribute to support in other areas. Perhaps more attention should be paid to inviting support and less to forcing it.

We must also recognize that the arguments, pro and con, over ocean ranching have fallen into the hands of only a few individuals, the insiders. The have become so acquainted with the issues and so articulate in defending their long held positions that others, the outsiders, are shut out of the

discussion. We hope that this assessment will help the outsiders take part in the decisions to be made for ocean ranching and to do so on an informed basis.

Part 1 - Background and Update

The purpose of this part of the Assessment is to describe Oregon's Private Salmon Ranching as it began, as it relates to public harvest and as it is today. We will describe it in several overlapping ways as this is, indeed, a complex weave.

A. The Origin of Salmon Ranching

Public and private ocean ranching, in the form of salmon hatcheries producing a juvenile fish for release to return as adults, has been with us for a long time.

Private salmon ranching is over 100 years old in Oregon. The first private salmon hatcheries in Oregon were built in the 1870's with hatcheries operated by R. D. Hume on the Rogue River and the Oregon Propagation Company on the Clackamas River. However, by 1900 the government had taken over operation of all salmon hatcheries in the state.

Transplanting salmon to other locations has been the justification for the develop of a number of public facilities. This includes such as the successful efforts in New Zealand in 1900. However, these efforts were not universally successful. More than thirty attempts were made to transport Pacific salmon into the Great Lakes before it was accomplished on any scale.

The first major Pacific salmon hatchery planned to mitigate damage from dam construction was probably the hatchery build at Leavenworth, Washington as part of the Grand Coulee Dam project. Sadly, success in this and other mitigation efforts was not easy to come by and early hatchery successes were hard to objectively demonstrate.

Ad-hoc efforts at a commercialization of ocean ranching were probably initiated by canneries in Alaska (and in other areas) planting eggs crudely stripped from fish bought for processing. This approach was not continued.

However, overfishing, mismanagement and environmental degradation lent support to efforts to develop a technology that would "bring back the salmon" and the Corps of Engineers, the power companies, public and private groups, and state governments provided the money for the research. Progress was made and by 1960 there were enough good examples, as measured on the balance of "public good" to bring public ocean ranching into public favor. These were reinforced in the 60's by a visible success in Michigan (though it was not without its detractors) and television's willingness to film salmon coming up hatchery ladders on slow news days.

In the late '60's and early '70's a number of enthusiasts began to visualize the possibilities of private ocean ranching as a commercial undertaking. The availability of salmon propagation technology being developed by state and federal agencies and thought (perhaps prematurely) to answer all of the problems and a common perception that private industry could do it better, encouraged investors in nearly every temperate climate country to "think salmon".

The four western states each took on the issue of "Should private salmon ranching be permitted and if so, under what conditions". The argument was joined.

Those that supported the concept argued that since the released fish would be public property after they were released and until they came back, they would be "free" additions to the ocean harvest; that private economic success would have broad public benefits; that mom and pop could grow a few salmon smolts in their back yard and live in modest comfort far from the city; that the mitigation

hatcheries with their site constraints and river losses could never replace the natural runs; and that only the efficiency of best sites and commercial drive could solve the problem.

The detractor's arguments ranged from social philosophy, "Private industry should not benefit from the public pasture", to the technical "They will be a source of disease and genetic contamination", to the naturalistic, "I can always spot a hatchery salmon, they don't fight as hard and their meat is white", to those who felt: "The big companies will use their influence to call all the shots and they will manage the state's fishery and the fishermen will dance to their tune".

Each side had a hundred more arguments but in the end the political process produced four different results:

> **Alaska** bought the concept and put fisherman owned non-profit cooperatives in control. A number of facilities have been built from harvest taxes. Their program appears to be successful and expanding.
>
> **California** passed a law allowing private ocean ranching but only one permit was activated. The returns are minimal and the owners are trying to get financing for a salmon tank farm on the site as ocean ranching alone is not enough.
>
> **Washington** refused the concept, except for several small, non-profit efforts. Attempts to change the legislative mind have failed and salmon pens and tank farms appear to be the form of the future, siting issues notwithstanding.
>
> **Oregon**, in the early 1970's, passed laws to make private ocean ranching possible and became America's testing grounds for the concept. In four short years (1974/8) twelve permits were issued and significant construction undertaken. In 1977, Crown Zellerbach (C-Z) made application and the same issues that defined the legislative debates were reconsidered, but this time, the courts made the decision and the C-Z application was rejected. This was reinforced in 1982 when a state moratorium on new permits was put in place. It runs until 1991.

B. The Chronology of Salmon Ranching

Chronologically, the events that have impacted ocean ranching are:

1870's - The first private salmon hatcheries in Oregon were built.

1900 -1904 - Over these 4 years, 500,000 Sacramento eyed chinook salmon eggs (per year) are transported to New Zealand in an "ice room" in the hold of a sailing ship. After hatching they are released in 21 rivers as sac-fry. This was the basis for the introduction of salmon runs, unsupported by hatcheries, that continues today.

1935 - As a little known part of the Grand Coulee project, a major chinook mitigation hatchery is constructed at Leavenworth, Washington. An engineering marvel, this facility produced little demonstrable results in terms of escapement or harvest.

1960 (Approx) The impact of Columbia River dams on salmon runs results in the beginning of a well funded research effort in hatchery design.

1965 - Japan reports that returns from its chum hatcheries are 1/2% or less. Within 3 years returns were in the 1 - 2+% range where the have remained since.

1966 - Planning begins for the first of the major "modern" mitigation hatcheries, the Dworshak Steelhead hatchery, the Cowlitz Salmon and the Cowlitz Anadromous Trout hatchery. Confidence in "fish factories" begins to grow.

1967 - Total returns from pacific coho plants into Lake Michigan in 1966 appear to be well in excess of 30% or over 200,000 fish. Returns continue in that range for coho and approach 20% for Chinook. A $22 million dollar salmonid hatchery construction program begins.

1971 - The Oregon legislature legalizes the private ocean ranching of chum salmon to allow individuals or corporations, after certain conditions have been met, to release small chum salmon into coastal waters. While these fish remain at sea they are public property, but when they return to their point of release they once again become private property and can be sold by the private ocean rancher.

1971 - Oregon Aqua-Foods (OAF) is established.

1971 - The first chum salmon ranching permit in Oregon is granted in December of this year to Keta, Inc.

1972 - The first private release of chum salmon (under the private ocean ranching rules) takes place from the Keta, Inc. site south of Tillamook .

1973 - The Oregon legislature expands earlier legislation to include the private ocean ranching of coho and chinook salmon.

1973 - The Alaska salmon harvest reaches a 23 million fish low as compared to 100 million+ harvest in the late 1930's and 100 million+ harvest in the early 1980's. These harvests are based almost entirely on natural salmon production.

1974 - Anadromous Inc. is founded

1974 - The State of Alaska passes legislation to allow construction of private non-profit (PNP) hatcheries.

1974 - Oregon Aqua-Foods receives a permit for coho and chinook salmon releases at Yaquina Bay and makes their first releases.

1975 - Oregon Aqua-Foods is purchased by the Weyerhaeuser Company.

1976 - Alaska voters provide $29 million for the construction of state owned hatcheries. Prior to this time the state's programs were minimal. Initial construction of both state and private non-profit (PNP) hatcheries is to begin in the following year.

1976 - Anadromous makes first releases of salmon at Coos bay. Together with OAF the coho release is 2.08 million smolts. The release of coho smolts from Oregon's coastal hatcheries is 4.0 million fish.

1977 - Crown Zellerbach applies for a permit for ocean ranching at a site on Tillamook Bay. After review the permit is granted by the Fish and Wildlife Commission but this granting was later reversed by the courts. It is generally, considered that this reversal resulted in the current moratorium on new and/or expanded permits. Some will argue that this effectively precludes new and/or expanded permits even if the moratorium were cancelled.

1977 - Japan's release of chum salmon juveniles exceeds one billion. Returns are on the order of 2%.

1977 - Oregon Aqua-Foods starts operation of their Springfield hatchery for the freshwater rearing of salmon.

1978 - Permits are granted for ocean ranching of chinook and coho by Domsea at Siuslaw Bay and by Burnt Hill Salmon Ranch at a site south of Gold Beach.

1978 - Charter (Oil) Company purchases Anadromous.

1979 - The Oregon legislature expands earlier legislation to include the private ocean ranching of pink salmon.

1981-Private hatcheries release 23.9 million coho smolts. The release of coho smolts from Oregon's coastal hatcheries is 3.9 million fish.

1981 - For the first time, the contribution of the Oregon private hatcheries to the ocean fishery exceeds 100,000 cohos. In this year 183,000 "private" cohos were caught at sea (Table 2) and 118,000 are harvested at private hatchery release sites. The 1980 coho releases were 14.8 million coho (See Coho Balance Table in the Appendix.) thus the total ocean survival exceeds 2%.

1981 - British Petroleum purchases Anadromous from Charter (Oil) Company.

1981 - The Salmon and Trout Enhancement Program (STEP) is approved by the legislature to provide for direct citizen involvement in salmon and trout propagation.

1982 - A moratorium on the issuance of new permits for private ocean ranching is established by ODFW through 1985 and later extended through 1990.

1982 - Anadromous purchases Oregon Aqua-Foods facility at Coos Bay.

1982 - The ODFW State Coho Plan is adopted with these being some of the objectives:

> 1) Achieve an annual average of 2.5 million adults in the OPI area consisting of 1.77 million hatchery and 0.73 million wild coho salmon.
>
> 2).....
>
> 3) Achieve by 1987 an average annual escapement of 200,000 wild adult spawners in coastal rivers to optimize natural production.
>
> 4)...
>
> 5) Provide an opportunity to harvest a annual average of 2.2 million adults in the OPI area consisting of 1.67 million hatchery and 0.53 million wild coho salmon.

1983 - Burnt Hill Salmon Ranch, Inc owners turn the facility over to the creditors. It was sold to the high bidder, Ocean-Pacific Salmon Ranch.

1983 - Domsea's last releases are made at Siuslaw Bay, though harvest operations continue at the site for three years.

1983/4- "El Nino" an ocean condition widely blamed for low salmon returns, is at its "worst". Total returns (including escapement) in these years from private coho plants average below 1%.

1983 - Japan's release of chum salmon juveniles exceeds two billion. Returns are on the order of 2%.

1984 - Anadromous constructs a freshwater facility near Klamath Falls.

1985 - Japan's harvest of chum salmon of hatchery origin exceed 49 million fish.

1985 - Sports catch of coho and chinook salmon in Lake Michigan is approximately 1,300,000 fish, all of hatchery origin.

1985 - The returns of Oregon private hatchery chum salmon are at a peak this year, 3,220 fish. This is a return of approximately 0.12% of the chum released by private facilities.

1985 - The Weyerhaeuser Company, Oregon Aqua-Foods owners, announce their desire to sell the company.

1985 - The $8.8 million ODFW Irrigon Hatchery is completed and the ODFW Wallowa Hatchery expanded ($2.2 million). New ponds are constructed at the coastal Salmon River Hatchery.

1985 - Legislation is introduced to require tagging of all privately released fish. It did not pass.

1986 - 70,800 chinook return to private ranches; 37,100 are caught in Oregon's coastal landings (which totals 424,000 chinook) and 27,700 are caught in the non-Oregon harvest.

1986 - More than 5% (453,000 fish) of the 8.6 million coho released by private hatcheries on the Oregon Coast in 1985 return as adults to those hatcheries. In addition, approximately 135,000 are harvested by sports and commercial fishermen. Total survivals (catch plus hatchery returns) from 1985 coho plants are over 6.8%. This return rate is approximately five times the 1978-84 values. Coho landed in Oregon total 652,000 fish including the 95,000 fish contributed by private hatcheries.

1986 - The West Coast total harvest (California to Alaska) is 7,893,000 coho and 2,511,000 chinook.

1986 - Production of farmed Atlantic Salmon in Norway is approximately 40,000 metric tons or 13,000,000 fish. World harvest of chinook and coho salmon varies between 45,000 and 60,000 tons per year.

1987-Private hatcheries release 4.6 million coho smolts down from a peak of 28.9 in 1981. The release of coho smolts from Oregon's coastal hatcheries is 4.9 million fish which is about 25% more than the average for the 1970-87 period.

1987 - 10 years after initial construction began, the Alaska State owned hatcheries and other rehabilitation and enhancement projects are credited with catch and escapement totals of 70,000 chinook, 394,000 coho, 975,000 chum, 1,309,000 sockeye and 4,038,000 pink salmon. The private non-profit (PNP) hatcheries are credited with 9,000 chinook, 169,000 coho, 955,000 chum, and 17,963,000 pink salmon. The PNP's are an integral part of the state's production and management programs.

1987 - Governor Goldschmidt vetoes legislation that would have made the purchase and operation of Oregon Aqua-Foods (and other facilities including ODFW hatcheries) by a state sponsored non-profit organization possible. Some perceive this as a desire to "give ocean ranching a chance". The veto message , however, focuses on a need to not split the management of the salmon resource and the "excessive" fee that would be charged the commercial fishermen.

1987 - Legislation is introduced to require tagging of all privately released fish and prohibiting the release of any coho or chinook not of local stocks. Neither issue passes.

1987 - ODFW, as a result of concerns over perceived impacts on natural stocks in the Yaquina River, reviews Oregon Aqua-Foods coho operations and directs a series of actions, to provide data on impacts and their control.

1988 - In June, the Weyerhaeuser Company announces plans to sell Oregon Aqua-Foods to Oregon Salmon Development, Inc. and reaches an agreement in principal for such a sale. Financial arrangements are not yet completed. Earlier Oregon Salmon Development, Inc. had indicated interest in the purchase of the Domsea Siuslaw Bay facilities but that has not yet taken place.

1988 - Due to a series of natural events, the runs of naturally spawning salmon, especially pink and chum salmon in southeastern Alaska and Prince William Sound, are at very low levels. Most harvest activities are based on private non-profit (PNP) hatcheries with PNP harvest well in excess of 10 million fish. (incomplete data)

C. The Statistics of Oregon's Salmon Ranching

One way to define Oregon's salmon ranching is with statistics. We will present a few in the form of figures and tables to describe the private operations and their relationship to the ODFW operations:

Figure 1 locates the 12 permitted private salmon hatcheries.

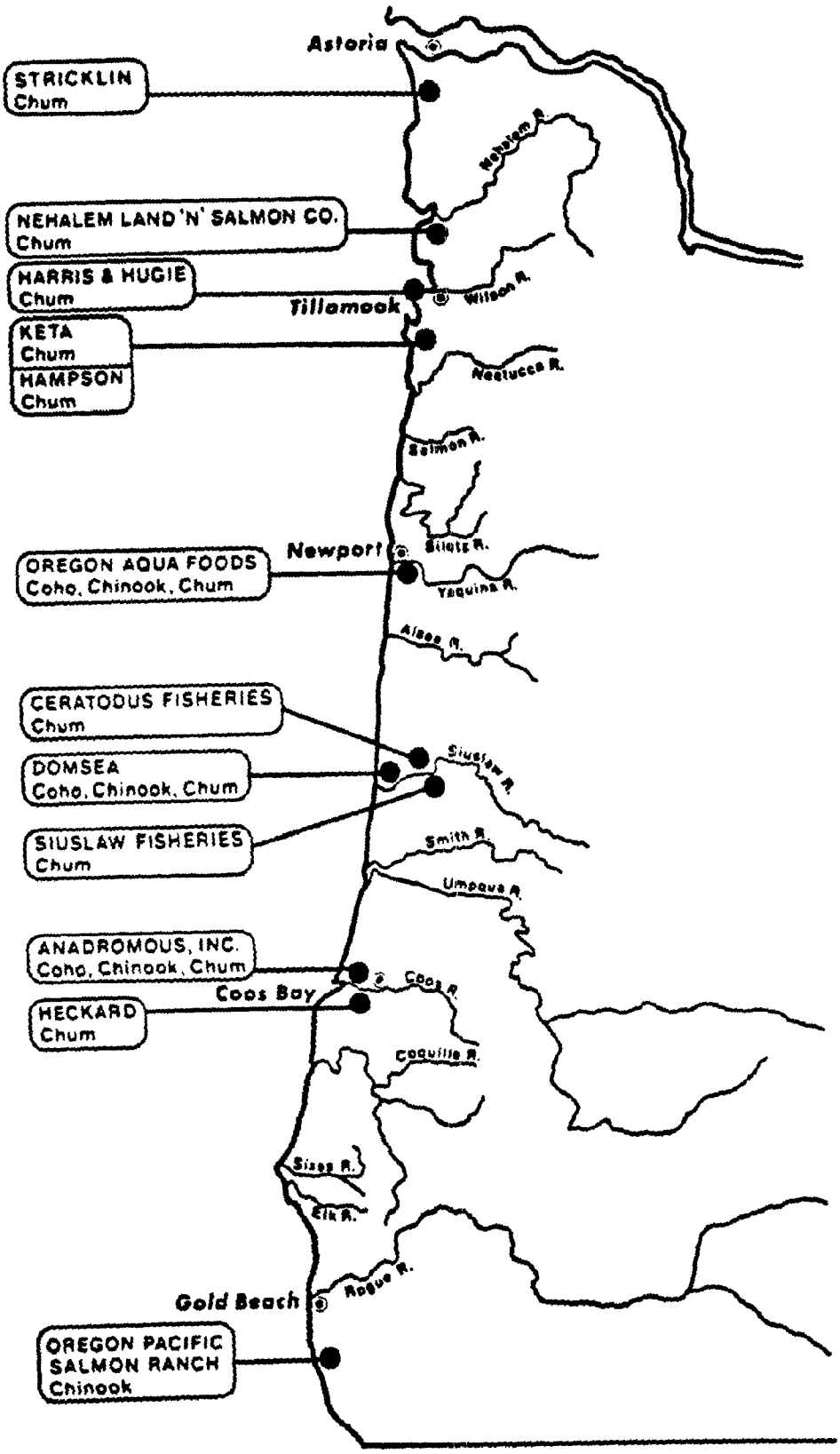

Figure 1
The Location of Authorized Private Salmon Hatcheries (i.e. Release Sites) in Oregon
(Credit: ODFW-T. Edwin Cummings, "Private Salmon Hatcheries in Oregon, 1986")

Table 1 describes the permits (active and inactive) now in force and compares the granted permit to actual recent activities. In gross terms, 1987 saw 26 million "private" fish released as compared to permits for 170 million. 1988 will see 17 million fish released.

(Note: Three tables in the appendix provide detail on some of these statistics and their derivation. In general and unless otherwise noted, these statistics are from ODFW sources. All fisheries data are subject to varying degrees of discussion no matter the source and this is no exception. However, we believe this information to reasonably reflect reality and found no obvious or intentional distortions. Part 3 provides added discussion on the derivation of this information.)

Table 1 Permits

Current Permits - Active						
				Release	1000's	1000's
	Release	Specie	Permit	Permitted	Plant'd	Plant'd
Operator	Site	Permitted	Date	Millions	1987	1988
Anadromous, Inc.	Coos Bay	Chinook	7/30/76	9.4	5,323	1,075
Anadromous, Inc.	Coos Bay	Coho	7/30/76	11.3	477	1,200
Heckard	Coos Bay	Chum	3/4/76	5.0	22	
Keta, Inc.	Sand Creek	Chum	12/1/71	5.0	125	
Nehelem Land n' Salmon	Nehelem Bay	Chum	3/4/76	5.0	208	200
Oregon Aqua-Foods	Yaquina Bay	Chinook	3/19/74	10.6	4,488	4,000
Oregon Aqua-Foods	Yaquina Bay	Coho	3/19/74	9.5	4,092	4,000
Oregon Aqua-Foods	Yaquina Bay	Chum	11/1/72	20.0	200	
Oregon-Pacific	Burnt Hill Cr.	Chinook	4/25/78	5.0	679	866
	Annual Smolt Release in Millions			Chum	0.56	0.20
				Coho	4.57	5.20
				F.Chin	0.00	0.00
				Sp.Chin	10.49	5.94
				Chinook	10.49	5.94
	Total Active Permits		Chum	35.0	1.6%	0.6%
	(and a % of total active		Coho	20.8	22.0%	25.0%
	permits utilized)		Chinook	25.0	42.0%	23.8%
Current Permits - Inactive						
Anadromous, Inc.	Coos Bay	Chum	7/30/76	20.5		
Ceratodus	Siuslaw River	Chum	12/18/73	5.0		
Domsea	Siuslaw Bay	Chinook	5/5/78	12.0		
Domsea	Siuslaw Bay	Chum	5/5/78	25.0		
Domsea	Siuslaw Bay	Coho	5/5/78	12.0		
Hampson (in Keta)	Sand Creek	Chum	10/31/73	5.0		
Harris & Hugle	Tillamook Bay	Chum	8/23/72	.1		
Siuslaw Fisheries	Siuslaw River	Chum	3/19/72	5.0		
Stricklin	Skipanon R.	Chum	3/4/76	5.0		
	Total Inactive Permits		Chum	65.60		
			Coho	12.00		
			Chinook	12.00		
	Total Current Permits		Chum	100.60	0.6%	0.2%
	(and a % of total current		Coho	32.80	13.9%	15.9%
	permits utilized)		Chinook	37.00	28.4%	16.1%
Note: For added detail see "Planting Master" Table in the Appendix.						

Table 2 tabulates the returns to the hatcheries and various fisheries. As indicated, certain private hatchery contributions were estimated by fairly crude ratios, but it was felt better to make such estimates than to ignore these contributions totally.

Table 2 - Returns

Return Estimates to Private Hatcheries and their Contribution to Public Fisheries.												
						Survival					Survival	
Year	Private Coho Returns to Hatchery (No.) Note 1	Private Coho Catch in OPI (No.) Note 1	Private Coho Catch Non-OPI (No.) Note 1	Private Coho Estimated Estuary Catch (No.) Note 2	Private Coho Estimated Total Catch (No.) Calc.	Coho OPI Ocean Catch÷ Return to Pr.Hatch. Note 5	Private Chinook Returns to Hatchery (No.) Note 3	Private Chinook Oregon Ocean Catch (No.) Note 4	Private Chinook Oregon Non-Ocean Catch (No.) Note 4	Private Chinook Total Ocean Catch (No.) Calc.	Chinook Oregon Ocean Catch÷ Return to Pr.Hatch. Note 5	Private Chum Returns to Hatchery (No.) Note 3
1978	12,300	21,500	3,600	492	25,592	1.41%	244	128	102	229		539
1979	49,200	40,300	25,200	1,968	67,468	0.91%	416	217	174	391	0.37%	14
1980	38,700	44,200	8,800	1,548	54,548	1.43%	3,394	1,774	1,417	3,191	1.04%	545
1981	117,800	144,600	33,900	4,713	183,213	1.78%	5,087	2,659	2,124	4,783	0.57%	477
1982	184,700	122,200	23,300	7,389	152,889	1.29%	12,083	6,316	5,046	11,362	0.95%	1,132
1983	133,900	135,200	107,300	5,357	247,857	1.17%	6,091	3,184	2,544	5,727	0.59%	515
1984	115,400	10,200	17,500	4,617	32,317	0.79%	6,299	3,293	2,630	5,923	0.38%	821
1985	332,000	63,300	29,100	13,281	105,681	3.69%	34,675	18,125	14,480	32,606	1.73%	322
1986	453,700	94,900	36,300	18,150	149,350	6.59%	70,784	37,109	27,739	64,848	3.89%	769
1987	119,300	170,000	10,800	4,773	185,573	3.38%	39,267	20,417	18,218	38,635	1.90%	323
Averages for 1978-87	155,700	84,640	29,580	6,229	120,449	2.24%	17,834	9,322	7,447	16,770	1.27%	546
Average for 1985-7	301,667	109,400	25,400	12,068	146,868	4.55%	48,242	25,217	20,146	45,363	2.51%	471
Note 1-Table 1, "Fishery Contribution of Coho Salmon Released from Oregon Coastal Private Hatcheries", Steve Jacobs, Fish Division, ODFW, May, 1988. (This data set used rather than data from "Private Salmon Hatcheries in Oregon, 1986" by T. Edwin Cummings, as this set was presented as both return and harvest data and as it is a more recent ODFW document.)												
Note 2-1986 Estimated coho estuary catch based on creel census. All other years estimated based on same % of Hatchery Returns.												
Note 3-Table II-7, "Review of 1987 Ocean Salmon Fisheries", Pacific Fishery Management Council, February, 1988.												
Note 4-1986 and 1987 based on ODFW memos (Steve Jacobs) dated 4/13/88 and 3/18/87. All other years estimated based on same % of Hatchery Returns.												
Note 5-For Coho see Coho Balance Master Table. Chinook assume that return in any year is based 10% on prior year's release, 60% on release 2 years prior, and remainder on 3 years prior.												
General note: The approximations noted in Notes 2 and 4 above reflect a lack of data for those years. Approximations were considered better than ignoring the probability of these contributions totally.												

Figure 2 indicates the estimated harvest levels for coho and chinook and the related mathematically derived "trend" lines. Accepting that "trending" is not a perfect approach, it does provide a fairly simplistic expression of what is widely recognized, the trend (1971-1987) for coho catches is sharply down and for chinook is slightly up. The coho values are in the OPI. The chinook values are Oregon landings for sport and troll caught fish. (OPI is the Oregon Production Index Area which includes coastal waters from Leadbettor Point in Washington to the California-Mexico border.) It is worth noting that some scientists see 24 year cycles in the longer term coho data and suggest that the mid 1990's may see a resurgence of coho returns.

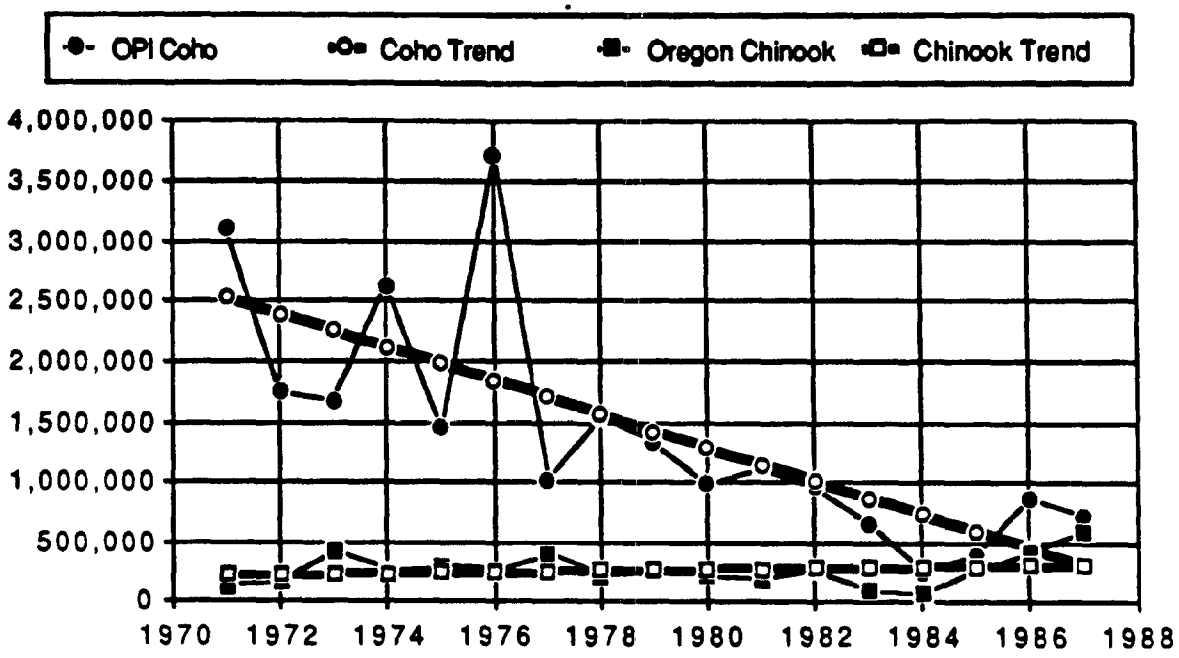

Figure 2
Harvest Trends for Coho in the Oregon Production Index Area
and for Chinook Landings in the State of Oregon

Figures 3 & 4 describe who is harvesting the fish in the ocean, mainly trollers for chinook, with the harvest of coho in the OPI being recently split between sportsmen and trollers.

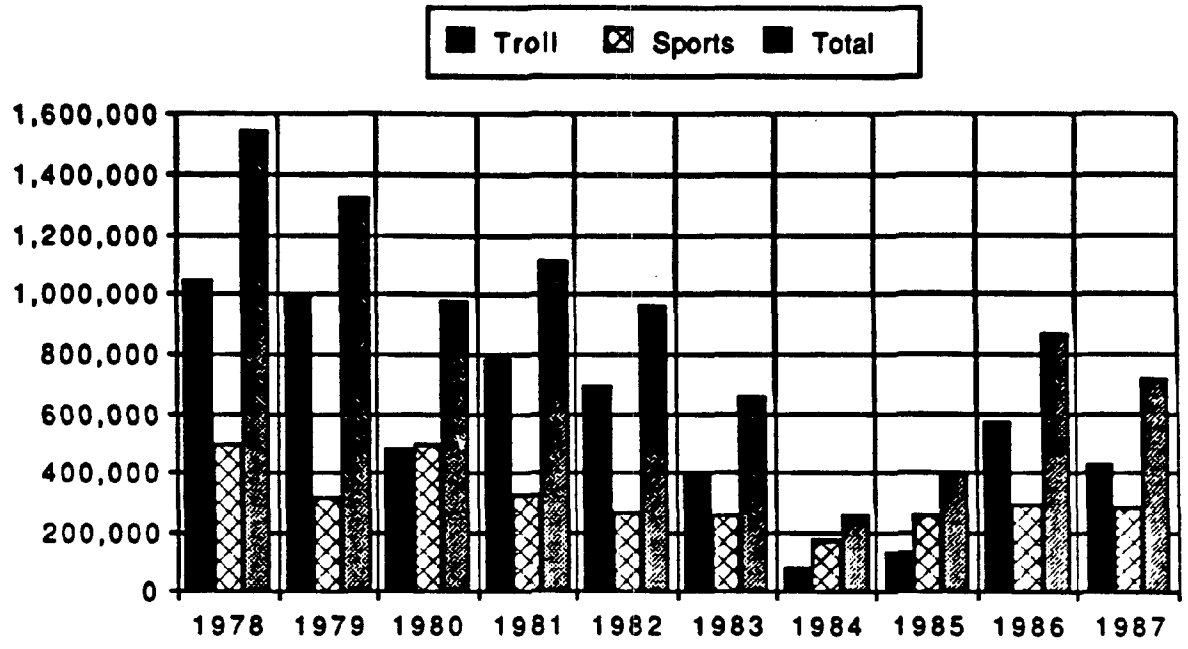

Figure 3
OPI Coho Troll and Sport Harvest

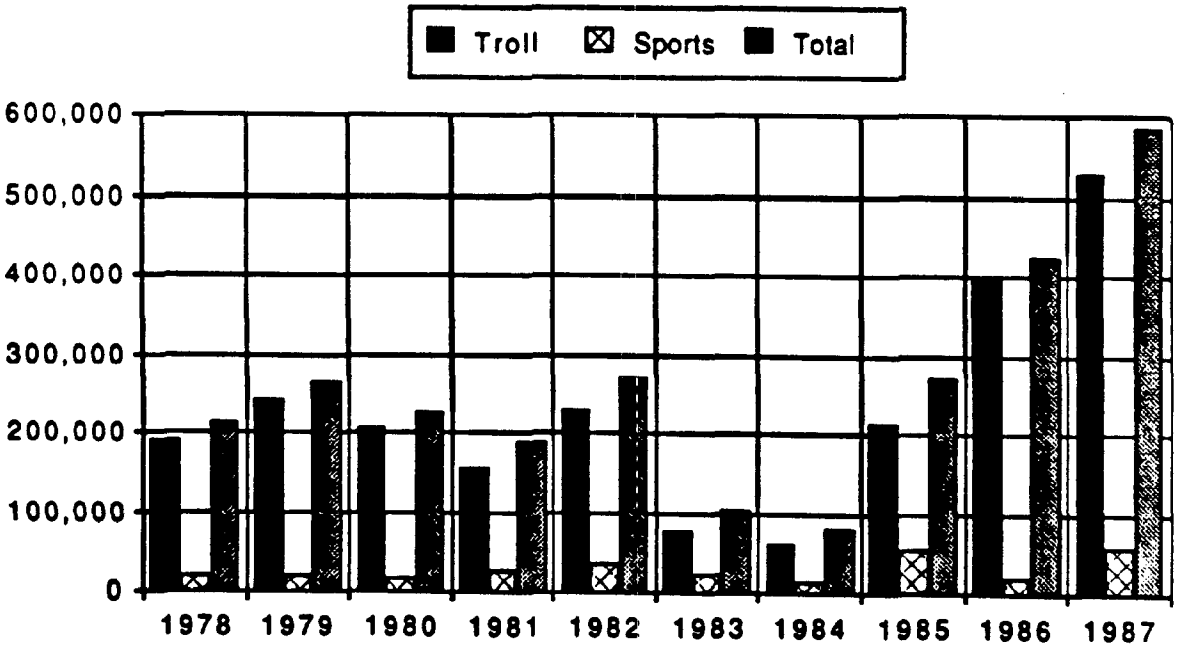

Figure 4
Oregon Chinook Ocean Harvest by Troll and Sport Fishermen

Figure 5 illustrates the history of salmon planting by private ranchers with an evolution to chinook. Figure 6 illustrates that spring chinook releases have displaced fall chinook as the favored program.

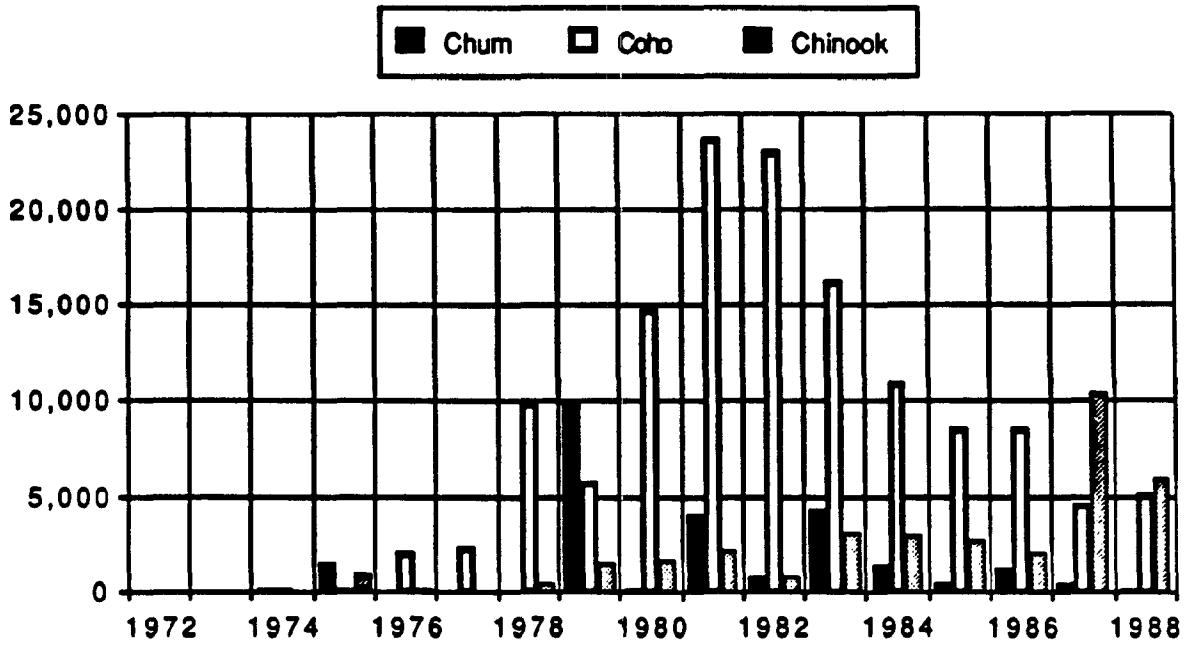

Figure 5
The Release of Salmon Smolts into Oregon Coastal Waters
by Private Salmon Ranchers (Numbers in 1000's)

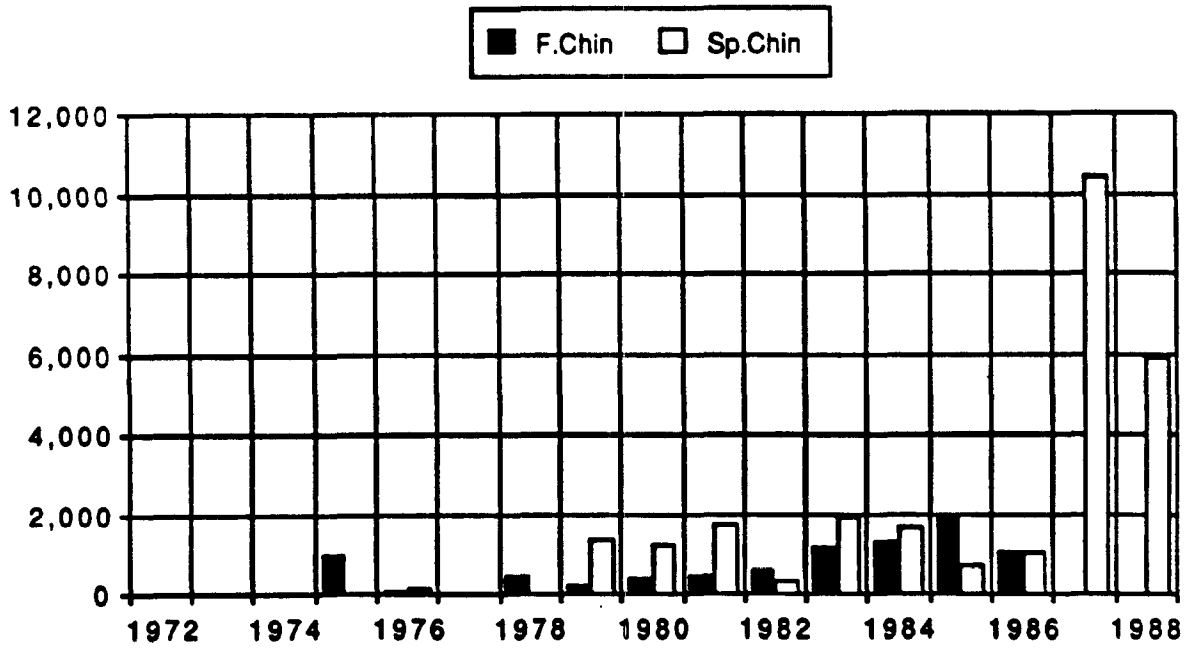

Figure 6
The Release of Spring and Fall Chinook Smolts into Oregon Coastal Waters
by Private Salmon Ranchers (Numbers in 1000's)

Figures 7 and 8 illustrate (by numbers and weight) the high proportion of coho in the private hatchery returns. For the first time, in 1987, the chinook returns approached the coho returns in terms of total weight.

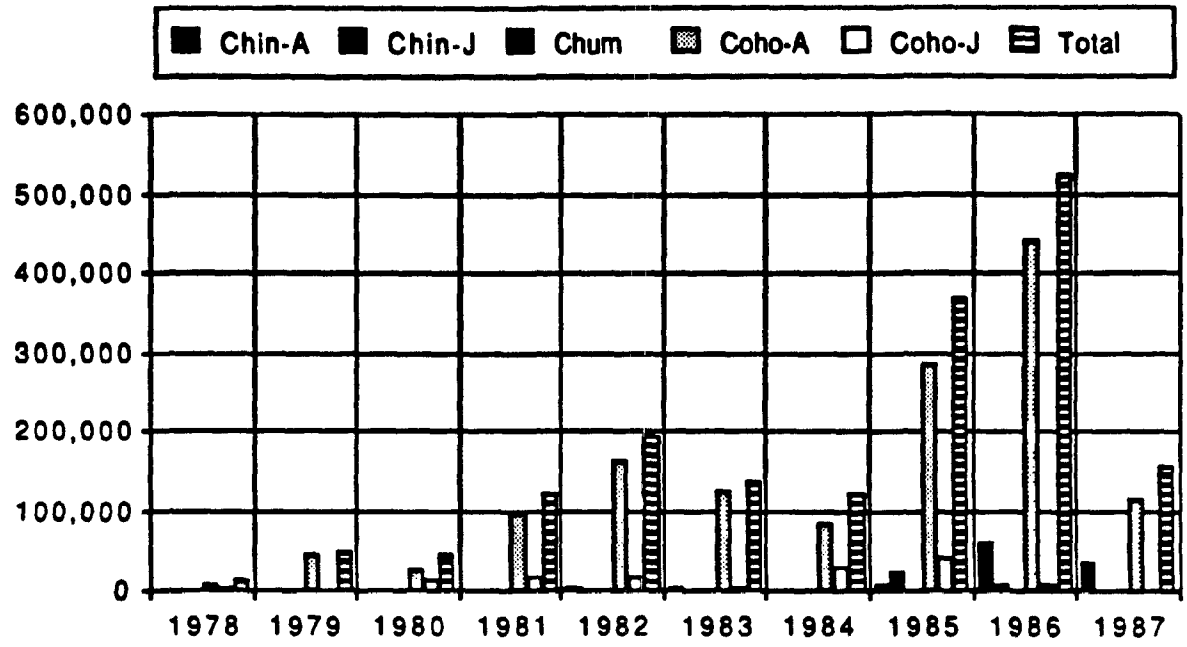

Figure 7
Returns to Private Hatcheries by Species
(Number of Fish)

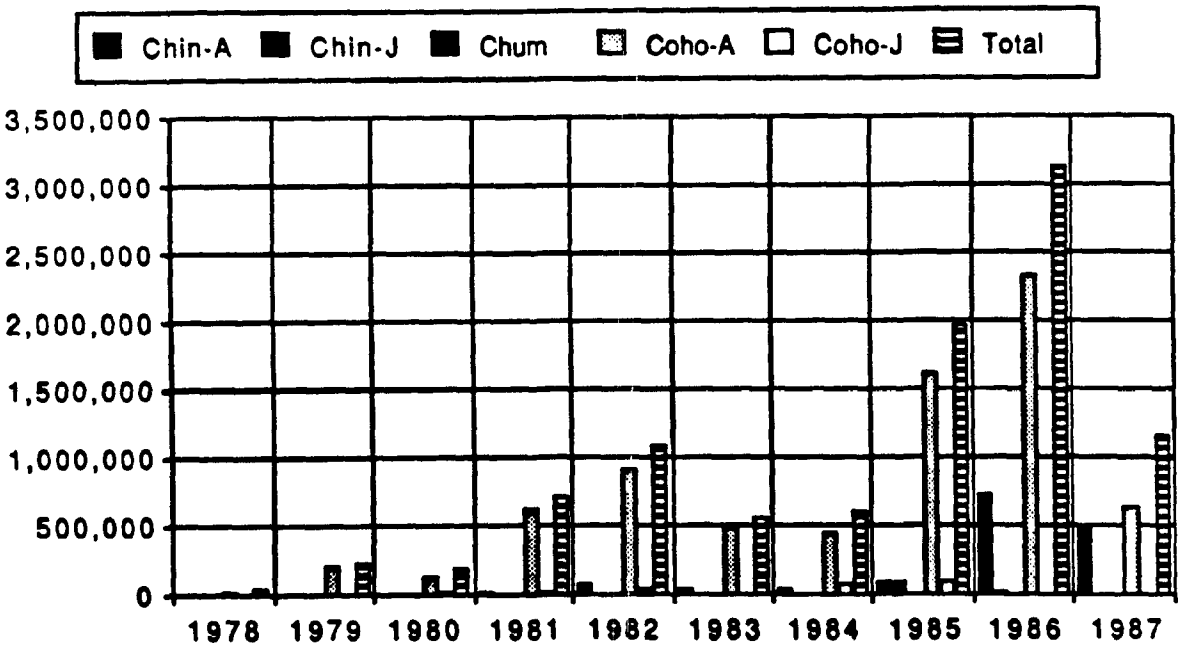

Figure 8
Returns to Private Hatcheries by Species
(Pounds of Fish)

Figure 9 summarizes the size at return of the various species. There is little clear trend towards larger or smaller fish. "Jacks" (shown as "J") define fish smaller than 24" for chinook and 20" for coho. Figure 10 describes the number of coho returning to coastal hatcheries (public and private) or to spawn in the natural environment.

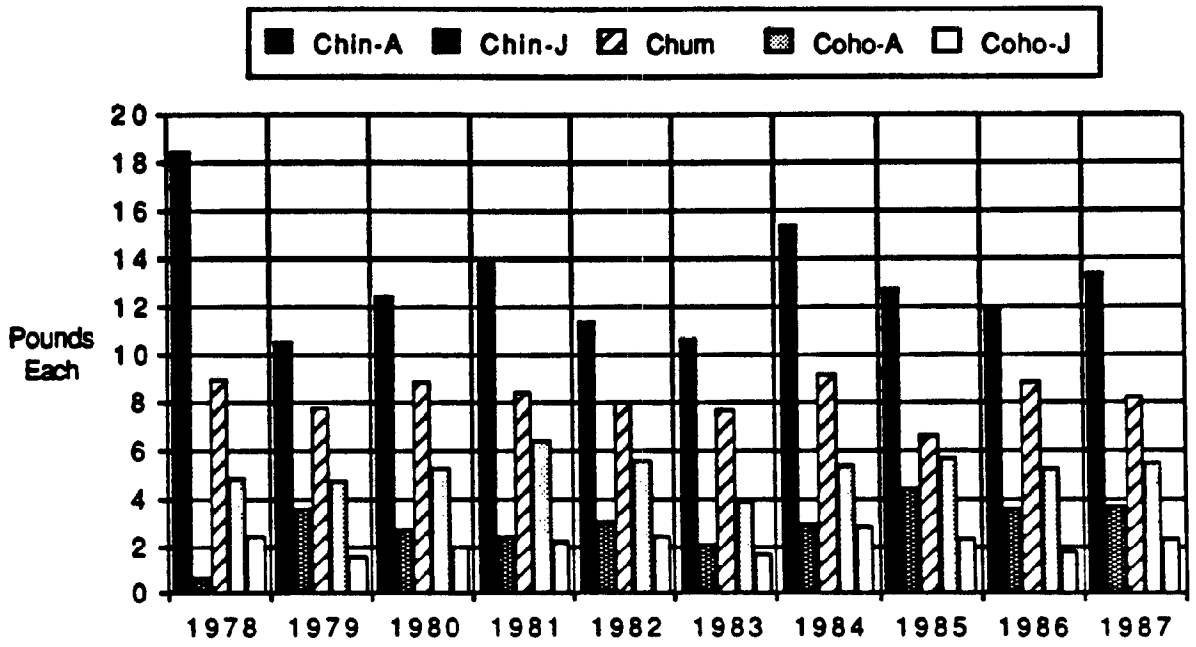

Figure 9
Average Size at Return to Private Hatcheries by Species
(In Pounds Each)

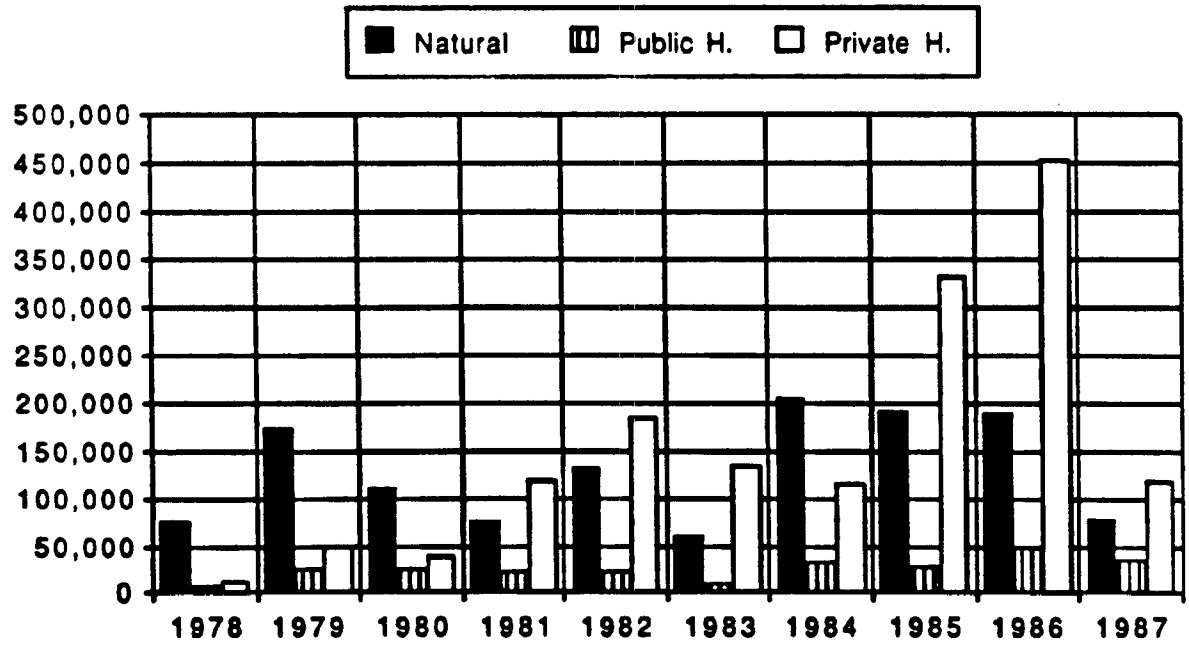

Figure 10
Coho Escapement to Coastal Hatcheries (Public and Private) and Rivers
(Number of Fish)

Figures 11 and 12 describe the ultimate fate of the "private" coho and chinook. "Private" fish is a term used here to describe privately released salmon. This makes no judgement as to who owns these salmon as they swim up and down the Pacific coast.

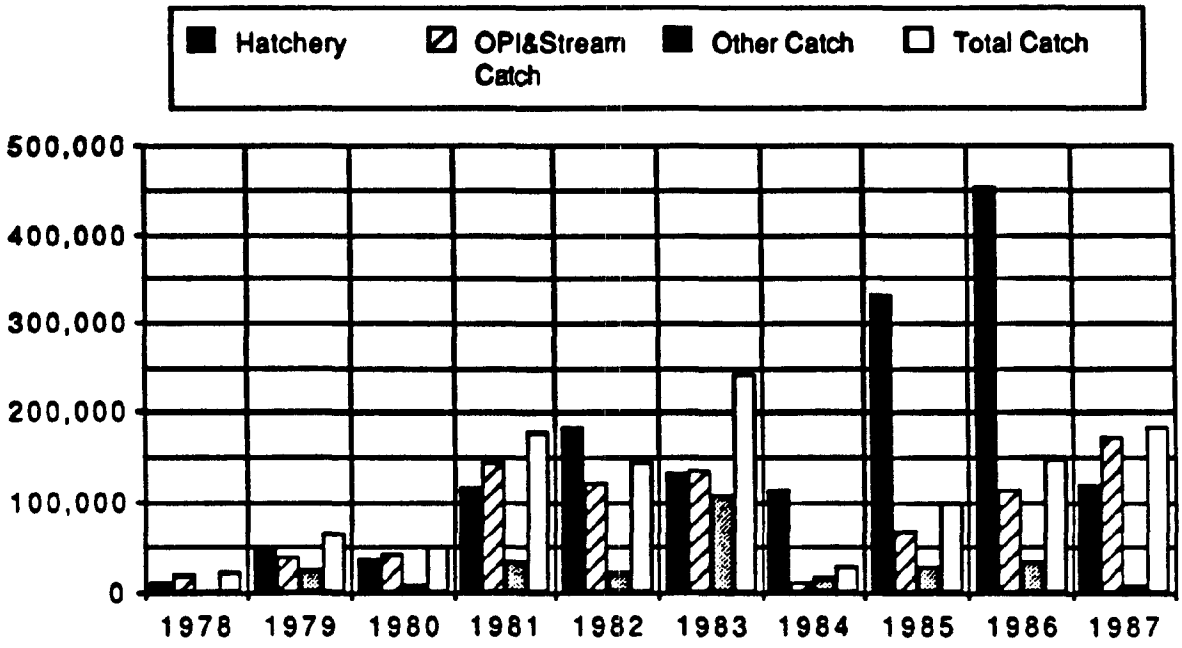

Figure 11
Where Privately Reared Coho Went
(Number of Fish)

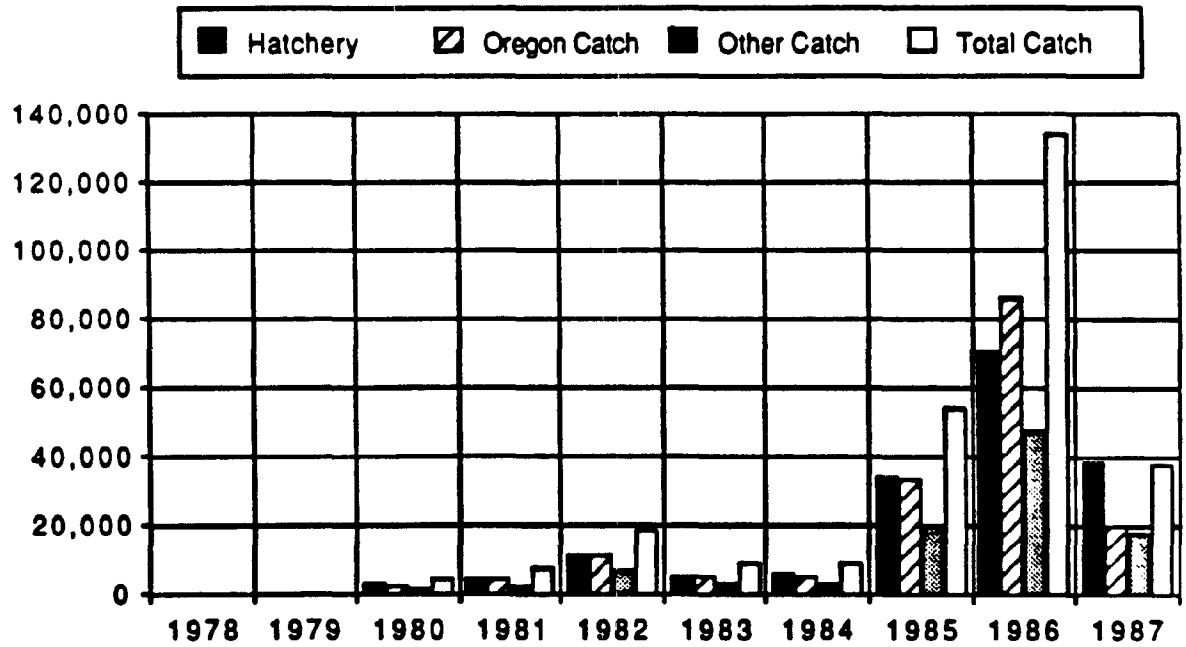

Figure 12
Where Privately Reared Chinook Went
(Number of Fish)

Figures 13 and 14 describe where the caught fish came from with the natural coho contributions going down and the private hatchery contributions generally trending up.

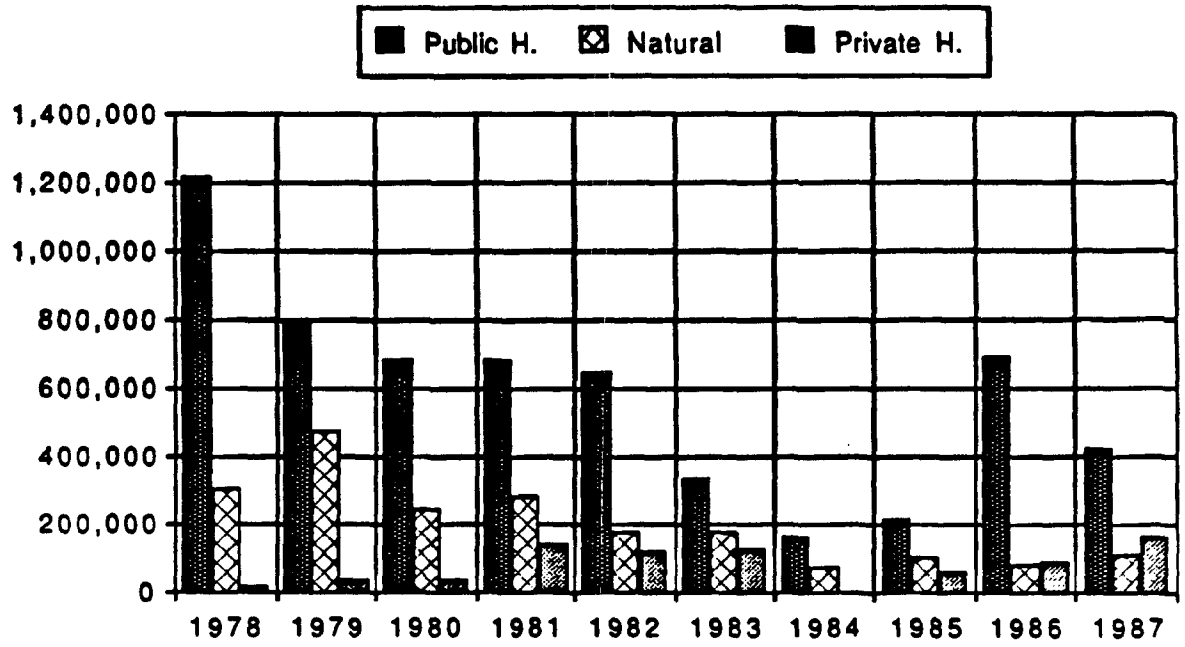

Figure 13
Origin of Coho Caught in the Oregon Production Index Area
(Number of Fish)

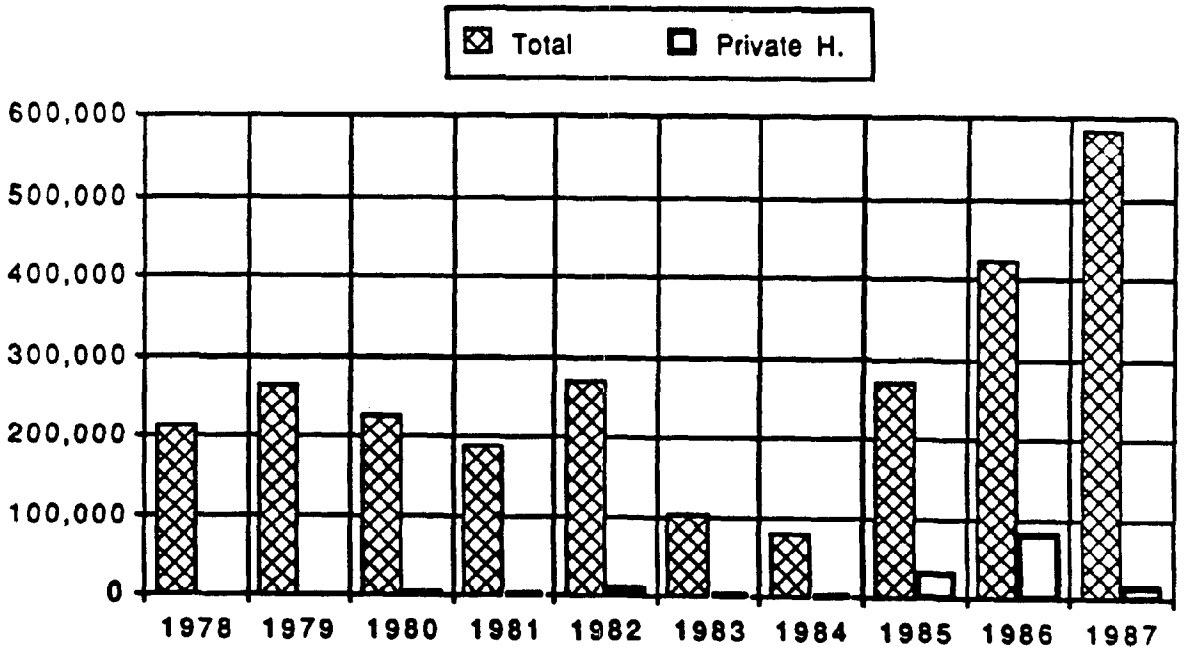

Figure 14
The Relative Private Contribution of Chinook to the Oregon Ocean Harvest
(Number of Fish)

Figure 15 describes the return percentages for public coastal and private hatcheries for "total" survival (i.e., ocean and in-river catch and escapement). The derivation of these numbers is described on the tables titled "Coho Balance Master" in the appendix. This is only one of several interpretations that can be put on the public coastal hatchery survivals and it may not recognize all returns. However, it is fairly consistent with qualitative information received elsewhere which suggest that the private hatchery survival rates appear to be exceeding the public hatcheries over the last three years of data.

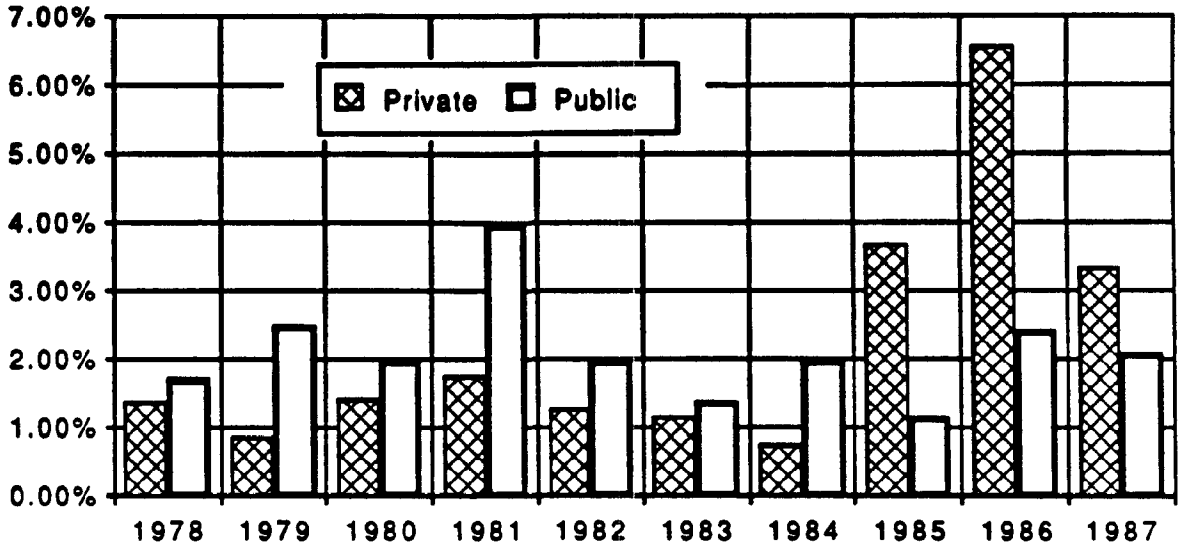

Figure 15
Survival Percentages of Coho Reared in Coastal Public and Private Hatcheries
(Survival includes escapement and harvest in the OPI area and in streams,
ocean harvested coho from outside of the OPI not included)
See "Coho Balance Master" Table in the Appendix.

D. Technology & Research

Another way to define private salmon ranching is in terms of technology and research.

In general terms, the fish propagation technology and the applied research that is a part of private ocean ranching is somewhat ahead of that at ODFW hatcheries. (This may be reflected by the return percentages illustrated on Figure 15. On the other hand the differences may have little to do with the differing technologies.) This is a relatively recent event and is a product of the more focused incentives of private industry which have been applied to a foundation that was supplied, in large measure, by ODFW. However, to understand the differences it is worthwhile to explain them in proper context.

Reduced to its essentials, salmon ranching consists of rearing salmon smolts, releasing them to lakes or oceans and recapturing the survivors for some appropriate reward. Differences between public and private ocean ranching are reflected primarily by how rewards are determined. In a public system the reward is in satisfaction, praise, position and security as defined by income. You are well rewarded, one hopes, if you do the job asked of you which is typically to release healthy fish in appropriate numbers while not causing too much related legal or environmental damage or greatly exceeding a budget. That these fish return for harvest or spawning is of interest but the array of barriers to their return, man-made and natural, are many and such scorekeeping has only recently become a priority in state facilities.

In a private salmon ranching operation, the manager's reward is in satisfaction, praise, position and security as defined by income. However, how long that reward continues is in how many fish come back, El Nino notwithstanding. This tends to add a sense of urgency to private innovation in the development of ways to get more fish back home.

Oregon's private salmon ranchers are constrained by a number of requirements that, while they may consider them onerous, are also supportive of technical development. For instance, fish are tagged at a much higher rate in private hatcheries than public hatcheries. This costs money. It also allows a better evaluation of the survival of private fish. Similar programs, measuring production lot performance would have been of great value in both public hatchery and natural fish programs in the past. However, differing objectives have lead to differing programs.

Some other examples of how the private salmon rancher's differing objectives may be causing him to develop in some technical areas faster than the public hatcheries follow:

> Private salmon ranchers have been accused of endangering wild stocks by the straying of their fish before and after ocean migration. To improve this situation they are attempting to develop release strategies to reduce straying conflicts even when such strategies may mean lower returns to the hatchery. While these attempts may or may not be successful to a degree that will be fully satisfactory, the information thus developed represents technology that was not available to the same degree in the past.
>
> Private salmon ranching is limited to certain coastal areas and estuaries where good smolt rearing sites are hard to find. As a result the pattern of inland smolt rearing and coastal release sites has evolved. This has resulted in the development of effective, high volume, transportation systems by the private ocean ranchers.
>
> The cost of water for rearing and holding smolts (and the difficulty of finding good freshwater sites) has resulted in special attention being paid to ways to increase the effective use of water. One method that has been generally used by the private salmon ranchers is the use of pure oxygen injection into the water supplies. This typically will increase the number of fish that can be supported by a given flow rate of water by a factor of between 2 and 4.

While ODFW hatcheries can benefit from the use of similar technologies, there has not been much pressure to do so in the past. However, as the need is defined, the state has and will benefit from these private technology development efforts.

In its regulatory role, ODFW must respond to a number of concerns in areas of ocean survival, disease, genetics and environmental impacts as related to private ocean ranching. The intensity of these concerns, often externally expressed, has required that ODFW improve its technical capacity to respond beyond that required by its normal operations. At the same time, the private ocean ranchers have had to improve their ability to debate these issues. (In a larger sense, similar efforts have been required of a number of others including the legislature, professors, charterboat captains and many more.) This all provides a better environment for technical development .

While ODFW and the private hatcheries appear to be in conflict on occasions, work done by ODFW does contribute to technical development in private operations. For example, while the nature of the various migratory and harvest patterns of coast chinook stocks has been of interest for some time to fish managers, the clear expression of these patterns developed by ODFW in its "Description of (Chinook) Life Histories ....etc, January, 1988" is of technical value to private hatcheries and perhaps of more significance, is of real value to policy makers.

It is generally true that private industry can react quickly to personnel, policy or equipment needs that can be justified in economic terms. On the other hand, the economic justification must meet tests not common to State facilities. (i.e., short paybacks, cash flow.)

It has been asserted that private facilities grow smolts at less cost than ODFW hatcheries. This may or may not be true and, in the context of this assessment, is not of immediate interest. However, for

those who wish to make comparisons we can provide this perspective based on studies in a number of other states. The production of fish in state hatchery systems involves concerns not always common in private industry. The programs are often defined by a desire to reach certain mitigation goals and achieving certain political balances. The managers running these facilities are state employees doing a job that imposes state wage scales and employment practices that, while appropriate to larger social concerns, limit their ability to control the staff. There is little flexibility in setting hours and their duties include a range of responsibilities that have little to do with raising fish. In our opinion, where there are "cost" differences they are defined by the programs imposed on the hatcheries, not the people in them.

E. Existing Ocean Ranching Operations

Finally another way to define Oregon's ocean ranching is to describe what it really consist ofs today.

With all due credit to the rest of the permittees in the state, the Oregon private ocean ranching program consists of only three substantial operations:

Anadromous, which has release sites at Coos Bay and a freshwater rearing facility near Fort Klamath. In 1988 this group plans to release 1.2 million coho (55 grams) and 1.075 million spring chinook (average 40 +/- grams). These release numbers are an 80% decrease from the prior year for chinook and a more than double for coho. Operations started in 1974 by private investors but control has since been purchased by British Petroleum-North America. The present management indicates that they expect to be marginally profitable soon but that their concern over regulatory and harvest issues together with other issues related to parent company interest is causing them to direct their attention to other aspects of aquaculture.

Oregon Aqua-Foods, which has a release site at Newport and a freshwater rearing site at Springfield. In 1988 this group released 3.8 million coho (average 44 grams) and 2.3million chinook, mainly Rogue River Spring Chinook, (average 44 grams). These release numbers are a small decrease from the prior year. Ocean ranching operations started in 1974 and in 1975 the company was purchased by the the Weyerhaeuser Company. In 1985 the present owners announced a desire to sell the company and Oregon Salmon Development, Inc. has expressed a desire to purchase their operations and the facilities. This desire to sell grows in part from changing corporate objectives. The present management indicates that they are approaching profitability but that this is due to a broadening of their sales of smolts, pan sized fish and eggs rather than from ocean ranching. In 1987, the sale of harvested fish from ocean ranching was only 20% of the total income.

Oregon-Pacific Salmon Ranch, which has a release site on Burnt Hill Creek south of Gold Beach and an inland fresh water rearing site. In 1988, this group plans to release 850,000 chinook smolts at approximately 45 grams each. The entire release will be (RRSC). This release number is a small increase over the prior two years. Operations started in 1980 but the original owners were unable to continue operation in 1983 and the assets were sold to Oregon Pacific, Inc. The present owners indicate that they are marginally profitable and hope to be able to continue and expand present operations from project income and from new investors.

A fourth operation that could have significance is the **Domsea** facility at Siuslaw Bay. Its largest releases were about 800,000 chinook and coho in 1979. It is in a location considered by some to be a good one and has a relatively large freshwater supply at the release site. Releases stopped in 1983, after a period of disappointing returns and the facilities have deteriorated a great deal. Oregon Salmon, Inc, has indicated a desire to purchase this facility as have several other groups.

Thus, the above three operating facilities, plan to release just under 6 million chinook and 5.2 million coho in 1988. The permits of the above four operations would allow annual releases of over 32 million coho and 37 million chinook. Thus current release levels are a relatively small part of the nominal authorization. (See Table 1)

Chum Salmon operations have been a disappointment for all permittees due to a combination of low returns and unavailability of eggs.

F. Near-Term Private Salmon Ranching "Operating Scenarios"

As indicated above, three companies are currently releasing coho and chinook smolts and one more could. Their activities are at about 15-20% of permit levels. In addition to the permit limits, specific interim limits are in place for experimental releases of Rogue River Spring chinook until ODFW has gathered more information on impacts. A moratorium prevents others from obtaining permits through 1990 and some believe that the 1977 Crown Zellerbach permit denial extends the prohibition into the indefinite future.

In considering the various issues in the next part of this assessment it is useful to define reasonable prospects for near-term growth of ocean ranching. By doing this, one can examine impacts against realistic levels of activity at a limited number of sites rather than against an unlimited range of events.

Based on various factors we believe that the following represents a realistic range of operating scenarios through the year 2000. We have used specific numbers primarily as a way to illustrate magnitude of total planting operations, not to suggest specific corporate planning.

1. **Closure** - Of all operations (OAF, Anadromous, Oregon Pacific, Domsea).

2. **Limited Operations** (based on meeting farming needs) - Chinook: Anadromous, 1.5 million; OAF, 1.5 million; Oregon Pacific, 0.8 million; Total, 3.8 million. Coho: Anadromous, 0.5 million; OAF, 0.5 million; Total, 1.0 million.

3. **Status Quo** - Chinook: Anadromous, 3.0 million; OAF, 4.0 million; Oregon Pacific, 1.0 million; Total, 8.0 million. Coho: Anadromous, 1.0 million; OAF, 4.0 million; Total, 5.0 million.

4. **Expanded Operations** - Chinook: Anadromous, 6.0 million; Domsea, 6.0 million; OAF, 6.0 million; Oregon Pacific, 2.0 million; Total, 20.0 million. Coho: Anadromous, 6.0 million; Domsea; 6.0 million; OAF, 6.0 million; Total, 18.0 million.

5. **Maximum Operations** (Assumes full permit operations at all sites) - Chinook: Anadromous, 9.4 million; Domsea, 12.0 million; OAF, 10.6 million; Oregon Pacific, 5.0 million; Total, 37.0 million. Coho: Anadromous, 11.3 million; Domsea; 12.0 million; OAF, 9.5 million; Total, 32.8. million.

Scenarios involving higher levels of production will not be considered at this time.

G. Nature's Role

As one reviews this material it is clear that there is much about the outcome of private salmon ranching activities that are a direct result of actions by the owners, the fishermen, the environmental activists, the legislature, ODFW and others. Typically, plans are based on the hope (or fear) that last year's events will happen again if we just do what we did before only better. However, it is clear that much happens that is beyond man's control no matter what we think.

The moon sinks from sight
The old dog's barking stops
A night's job done.

Part 2 - The Statutes and Regulations

To understand private ocean ranching in Oregon it is necessary to understand the Statutes and Regulations that control it. That is the purpose of this discussion. (This discussion draws very heavily, and in large part, directly, from a 1980 pamphlet by Don Hornstein titled "Salmon Ranching in Oregon: State and Federal Regulations" and a ODFW update prepared by ODFW staff in mid-1988 for a special committee (The Committee of Six) established to review statutes and regulations for private salmon ranching.)

A. Background

In 1971, the Oregon legislature legalized the private ocean ranching of salmon. Private individuals and companies could apply for permits to operate their own hatcheries, raise young salmon from eggs, and then release them from facilities near the ocean. The fish that survived to return by instinct to their point of release could be used by the salmon rancher as seed stock from which the next generation of fish would be spawned or for sale. Although the 1971 law only authorized permits for chum salmon hatcheries, it was amended in 1973 to include coho and chinook, and, in 1979, pink salmon permits as well.

This legislation allowed the development of a number of salmon ranching operations. Not all of these operations are identical, yet all have these common elements:

An initial source of seed stock.

A hatchery, in which to incubate eggs and rear fingerlings.

A release-and-recapture facility near the coast.

A marketing operation.

These elements are regulated by a series of statutes and regulations and to obtain the necessary permits requires compliance with a number of legal procedures. Although each of these requirements may be supported by rational public policy, taken together, they form an intimidating bureaucratic maze that leads through a number local, state, and federal public agencies. Permits or authorizations are required from: local zoning agencies; the Oregon State Departments of Fish and Wildlife, Water Resources, and Environmental Quality; the Division of State Lands; and the U.S. Army Corps of Engineers. The ocean ranch may also be affected by regulations of the federal Environmental Protection Agency, Department of Agriculture, and Food and Drug Administration. This discussion will focus on the individual permits that are required by ocean ranchers and on the regulations that will impact their operations.

B. The Private Hatchery Permit

A commercial salmon rancher must have a private salmon hatchery permit for each species of salmon it releases. (Note: The term hatchery as used here refers primarily to the release and recapture facility and its operation. The actual growing of smolts for release is covered by the Wildlife Propagation License discussed elsewhere.) These permits are issuedand administered by the Oregon Department of Fish and Wildlife and are probably the most demanding of all permits for which an ocean rancher must apply.

1. Timing - The Department requires a minimum of six months for review and evaluation of a permit application and a public hearing is required as part of the review process. (The Department will not schedule a public hearing until an application is complete.)

2. Egg Sources - No application isreviewed until the applicant is within two years of receiving eggs. Private operators may not take wild coho or chinook salmon as a source of seed stock. The Department, however, is authorized to obtain seed stock from these species and to make the eggs available to private operations. In practice, wild stocks have been taken only if their natural production is replaced. Similarly, private operators may take chum salmon for seed stock only if their removal from a stream will not adversely affect the natural chum production. The terms and conditions under which native chum may be taken by private operators, if allowed at all, are part of the individual hatchery permit. Most applicants seek eggs from public and private hatcheries, both within and out of the state of Oregon. The Department is authorized to sell from their hatcheries only those eggs which are surplus to the fish production program of the state. Available surpluses are sold according to strict priority as provided in Oregon Administrative Rules (OAR) 635-40-015. Current surpluses are limited, when they occur at all, and the Department foresees that the situation may get worse if more permits are granted.

3. Sites - Assuming a source of eggs can be found, an application is not complete unless it identifies a site for the proposed operation in which the applicant has sufficient property right. A sufficient property right may be demonstrated by an instrument such as a lease, option or easement.

By law, a release-and-recapture facility must be in "close proximity to the ocean." This requirement was envisioned to prevent genetic mixing and competition of the privately raised fish with wild or public hatchery stocks. This might occur if the privately raised fish were released, and subsequently strayed, far upstream in spawning and nursery grounds used by other salmon stocks.

The Department of Fish and Wildlife has further defined where the release-and-recapture site may be located. It may not be located above the head of tidewater in any stream, except sites may be located a short distance above the mouths of small direct tributaries to the ocean which have no tidal influence. Operations may not be located next to wild, scenic, or wilderness areas or on streams which enter the ocean through tourist facilities such as state parks or waysides. In addition to these general rules, certain streams, rivers, and estuaries are specifically closed to ocean ranching.

4. Departmental Reviews: Resource and Economic Considerations - Once an application is complete, it is reviewed by the Department. Each application is examined in terms of its effect on the overall public fisheries of the state, the state's management of those fisheries, and the economic benefit to the state. In particular, Oregon Revised Statutes (ORS) 508.710 stipulated that permits must be denied if any of the following five conditions exist:

1. If the private hatchery may tend to deplete any natural run of anadromous fish or any population of resident game fish.

2. If the private hatchery might result in waste or deterioration of fish.

3. If the operation would be located on the same stream or river (or on one of their tributaries) on which a state or federal fish hatchery is established or planned.

4. If the operation would not be located on the same stream or river (or on one of their tributaries) on which a state or federal fish hatchery is established or planned.

5. If the Commission determines the applicant does not have the financial capability to successfully construct and operate the hatchery or may not properly conduct the operation. The state Attorney General issued an Opinion in 1975 in which he stated that this provision authorized the Commission to require a bond or public liability insurance from a permit holder, as an indication of adequate financial capability.

5. Departmental Review: Land Use Considerations - In addition to reviewing applications from a resource and economic viewpoint, the Department is required to determine the consistency of a permit with applicable state-wide planning goals. These goals were promulgated by the Land Conservation and Development Commission (LCDC) and have the force of law. State action which affects land use, such as granting a permit to a private salmon hatchery operation, must be consistent with LCDC's goals. The Department of Fish and Wildlife gives particular attention to Goals 5, 16, 17, and 19 defined below. The Department considers input from local jurisdictions in making this determination.

Goal 5, the Open Spaces Goal, seeks to conserve open space and protect natural and scenic resources. It is concerned with values such as fish and wildlife habitat, ecologically and scientifically significant natural areas, outstanding scenic views and sites, wetlands, groundwater resources, cultural and historic areas and energy sources, as well as with land needed or desirable for open space. If an ocean ranching operation is in conflict with these values, then the economic, social, environmental and energy consequences of the conflicting uses are identified and weighed. Uses which do not exceed the air, land, and water carrying capacities of the area are favored. Fish and wildlife habitat is managed with guidance from the Oregon Fish and Wildlife Department through development of fish and wildlife management plans.

Goal 16, the Estuarine Resources Goal, states that estuary plans and activities shall protect the estuarine ecosystem, including its natural biological productivity, habitat, diversity, unique features and water quality. Generally Goal 16 requires actions which would potentially alter the integrity of an estuarine ecosystem to be preceded by a clear presentation of the impacts of the alteration, and a demonstration of the public's need and gain which warrant it.

Goal 17, the Coastal Shorelands Goal, seeks to protect, conserve, restore, and where appropriate, develop the resources and benefits of all coastal shorelands. These shorelands include land one thousand feet from estuary shorelands and hence encompass land that an ocean ranch may need for its facilities. Coastal shorelands are three general groups: those in (1) urban areas; (2) rural areas; and (3) in particularly significant areas such as major marshes, significant wildlife habitat, coastal headlands, archaeological sites, and areas with exceptional aesthetic qualities. Goal 17 specifies aquaculture as an acceptable use in the urban and rural categories. It is appropriate in the third category, however, only if consistent with the protection of natural values.

Goal 19, the Ocean Resources Goal, seeks to conserve long-term values, benefits, and natural resources of the nearshore ocean and continental shelf. Priority is given to renewable ocean resource and uses such as food production, water quality, recreation, and aesthetic enjoyment. The Ocean Resources Goal states that actions affecting ocean resources be based on sound information. This information must be sufficient to describe the long-term impacts of a proposed operation on resources and used of the continental shelf and nearshore ocean.

6. The Public Hearing - Once a completed application is filled, the Department of Fish and Wildlife may take six months or more in which to review it and issue a preliminary report. Within the next sixty days the applicant must resolve differences he has with this report and the Department must issue a final report. The Department must publish a notice of public hearing within one month after it issues this final report. There is no time limit, however, between this publication of notice and the time when the hearing is actually held.

A public hearing is mandatory prior to issue of a private salmon hatchery permit. This formal hearing is held before the Fish and Wildlife Commission itself or a designated hearings officer. Parties who establish an interest in the case may be heard. Individuals with personal interests in the outcome of the hearing and individuals or groups representing a public interest must petition the Commission in order to intervene and participate in the hearing.

The actual conduct of the hearing is governed by the Attorney General's Model Rules of Procedure applicable to contested cases, supplemented by specific administrative rules adopted by the Fish and Wildlife Commission in order to intervene and participate in the hearing.

The actual conduct of the hearing is governed by the Attorney General's Model Rules of Procedure applicable to contested cases, supplemented by specific administrative rules adopted by the Fish and Wildlife Commission and found in OAR 635-40-100 to 635-40-115. These rules establish the overall purpose of the hearing, the criteria and procedure for intervention, and the parties' rights of presentation of evidence, cross-examination, objection, motion, and argument.

Public hearings are formal legal proceedings and may be more complex and lengthy than court trials. The transcript of one private hatchery permit hearing covered over 700 pages. An applicant is well advised to anticipate the formal adversarial character of their hearings and to enlist the aid of counsel in presenting his application. The hearing procedure may be very expensive for all parties.

7. The Decision - Following the hearing, the Department prepares a proposed order including findings of fact and conclusions of law, which it files with the Fish and Wildlife Commission. Copies of this order are also given to all the parties to the hearing who have fifteen days in which to comment on the proposed order. The Commission then reviews these comments, the proposed order, and the record of the hearing. The Commission may further require the parties to brief any or all of the issues at this point. The Commission is free to adopt, reject, or modify the Department's proposed order, as long as its action is consistent with the facts presented at the hearing and contained in the record. Finally, the Commission enters its final order granting or denying the permit and sets forth its reasons.

An applicant or any of the parties to the hearing may file a petition with the Oregon Court of Appeals for judicial review within sixty days of the final order. Such an appeal should be handled by an attorney for the party requesting review.

If a permit is granted, it is granted only to the applicant and is not transferable without Commission authorization. The Department of Fish and Wildlife must be notified of the names of any individuals, corporations, or other entities which gain a major interest or control, through stock purchases or otherwise, of either the hatchery permit or of the site designated in the permit.

Once the permit is issued, it is still possible for the Commission to alter or even terminated it, if the operation is discovered not to be in the public interest. Proceedings to change or terminate a permit are conducted according to the state Administrative Procedure Act relating to contested cases, ORS 183.300 - .500, and the Attorney General's Model Rules of Procedure. Should an operation be terminated, the permit holder is allowed to take returning salmon for up to four years, but may not release any new fish.

8. The Permit's Condition's - The Oregon legislature passed the Private Hatchery Act amidst concern that ocean ranching might adversely affect other stocks of fish and the traditional commercial and recreational salmon fisheries. This concern is reflected in the numerous conditions of law which apply to a private hatchery permit.

Once privately raised fish are released into the ocean, they become "public" fish and may be taken by anyone, in accordance with the angling or commercial fishing laws of Oregon, until they return to the private hatchery. This is a significant condition. It has been estimated that four out of every five adult fish will be taken by commercial or recreational fishermen. Although the private hatchery is required, as far as the Department determines practical, to mark its fish prior to release, the mark does not give the private operation a proprietary interest in the fish while they are in the wild. Upon the salmon's return, the ocean ranch may be authorized to divert returning fish to an identification area, but may only keep those fish the Department determines were propagated by the permittee.

Prior to release into state water, the young salmon must be examined for disease by an approved fish pathologist. No fish can be released without written approval from the Department. Thus, the Department can restrict releases within any permit limits. Should the fish be found diseased, the Department may order them destroyed without compensating the grower. In addition to these

conditions, the salmon rancher is responsible for the costs of all services rendered by the Department, such as inspections or services.

On an even larger scale, if the Department finds that a private operation, within the waters covered by its permit, has caused deterioration of the natural run of anadromous fish or of any population of resident game fish, it may require the operator to return the fish populations to the same conditions that previously existed. If the operator fails to take action, the Department may take such action and charge the operator with all costs.

C. The Wildlife Propagation License

If a salmon rancher contracts out his fish rearing to a separate rearing operation, owned by someone else or by himself, at a location other than the release site, the separate rearing operation requires a Wildlife Propagation License. These licenses are also issued and administered by the Oregon Department of Fish and Wildlife and must be renewed annually. Public hearings are not required. The Fish and Wildlife Department may refuse a license if the propagation of wildlife would tend to be harmful to the existing wildlife populations. To implement this standard, the Commission has adopted administrative rules covering the inspection of fish, eggs, the transportation of fish (both into and within Oregon). These regulations are found in OAR 635-07-650 through 635-07-680. Additionally, specific reports are required of private salmon hatchery operators whether they grow their own seed stock or buy them from others. Together, these requirements limit the potential for a private enterprise to rear salmon with the prospect of selling them for release. Stocks are closely controlled.

D. State Dredge and Fill Permits

If any party in Oregon, including a salmon ranch operator, must remove or fill more than fifty cubic yards of material (combined) from or on the beds and banks of state waters, a dredge and fill permit is required from the Division of State Lands. The general policies governing these permits are the protection, conservation, and best use of the water resources of the state. To determine if a permit holder would not adversely affect these goals, the Director of State Lands consults with other state agencies such as the Department of Fish and Wildlife, Department of Water Resources, and Department of Environmental Quality. A public hearing is not required but only an application is filed, the applicant or any person with a legally protected interest which could be adversely affected may request a hearing.

A permit from the State Division of Lands does not excuse the operation from the further requirement of obtaining a dredge and fill permit from the U.S. Army Corps of Engineers if it falls within the Corps' jurisdiction.

E. Federal Dredge and Fill Permits

The Corps of Engineers (COE) may be the federal agency with which the salmon rancher will have the most contact. A permit must be obtained for structures or work and for dredge and fill activities in "the waters of the United States." This requires a Section 404 permit, pursuant to the Federal Water Pollution Control Act Amendment of 1972.

The phrase, "waters of the United States" is quite broadly defined, and almost certainly encompasses either riverine or estuarine sites in which the salmon ranch operator must place his water intake and outfall pipes, release-and-recapture facility, and any protection or reclamation devices for bank or beach stabilization such as riprap, seawalls, or vegetation. "Waters of the United States" include all coastal and inland waters, lakes, rivers, and streams that are "navigable" waters (including their adjacent wetlands). "Navigable waters" have been defined to include all waters subject to tidal influence and any waters that have been, are, or might be used to transport interstate or foreign commerce.

The application process begins by submitting Engineering Form 4345 to the District Engineer in Portland. This form must be prepared in accordance with the instructions in Engineer Pamphlet A145-201, entitled, "A Guide for Applicants." Both the form and the pamphlet can be obtained from

the COE District Office in Portland. When an application form is complete, the District Engineer issues public notice of the proposed permit and is required to consider all public comments received in response.

No permit may be granted that is not in the public interest. The determination of the public interest is a balancing process which weighs the protection and utilization of important resources. Among the factors which must be considered in this process are conservation, economics, aesthetics, general environmental concerns, energy needs, food production and fish and wildlife values. If the requested permit affects wetlands, then particularly stringent and protection-oriented regulations must be considered.

In making its determination, the COE must consult with the Regional Directors of the U.S. Fish and Wildlife Service, as well as with other agencies, concerning the environmental effects of the proposed operation. The COE must also consult with the Oregon Department of Fish and Wildlife and other state agencies through a state clearing-house. Although public hearings are not mandatory, any person may request one within the period for public comment and it will be held unless the District Engineer determines the hearing would serve no valid purpose.

After the Section 404 permit application is evaluated, a final decision will be issued. If the permit is denied, judicial appeal of the COE decision may be sought under Sections 702 an 704 of the Federal Administrative Procedure Act.

F. Reservoir Construction Permit

A permit is required to store water for uses such as a hatchery's fish holding ponds. Applications for this permit are made to the Oregon Department of Water Resources. The legislative and administrative guidelines which the Department follows are found in ORS 537.300 and in OAR 690-20-025 to 690-20-045. The application for a permit to construct a reservoir must be accompanied by another application for a permit to make use of stored water.

A private hatchery operator should be aware that the common law takes a special view of water impoundments. A person is strictly liable for any damage caused by the escape of water from his reservoir, whether by a sudden cataclysmic crack in the structure or by slow seepage, and regardless of any precautions that may have been taken.

G. Water Rights Permit

The rearing of salmon smolts will require a steady flow of water for incubating eggs and rearing fingerlings. Especially in the hot summer months, an assured flow of clean water is vital for the temperature, dissolved oxygen, and waste removal requirements of the growing fish. Whether a salmon rancher utilizes surface or ground water, legally recognized water rights must be obtained from the Oregon Department of Water Resources.

With certain exceptions, all water within Oregon may be appropriated for beneficial use. To the extent minimum stream flows are in effect, the fact that most of the water diverted for hatchery operations is returned to the source is considered.

Oregon follows the "prior appropriation" doctrine of water rights. This means that the person who first files a valid claim to water has the superior right to its use, regardless of that person's position on the stream (upstream, downstream, near the source, etc.). Much of the water in Oregon today has already been "claimed." Thus, a hatchery operator should take pains to ascertain the extent of prior appropriation rights to the stream from which he hopes to divert water. If all the water rights for a stream have been appropriated, the salmon rancher may still be able to buy the water rights he needs from someone else. Water rights are freely transferable.

To acquire a legal water right, one files an application for a permit with the Director of The Oregon Department of Water Resources. An informal hearing may be held but is not required. If a permit is

granted, work must begin within one year to appropriate the water or the permit will lapse. Similarly, if a water right is unused for five years, it is presumed abandoned and reverts to the public.

Once a permit is granted, a water right must be "perfected" by actually appropriating the water to the beneficial use. When this happens, a certificate is issued by the Water Resources Director. This certificate should be promptly recorded with the county clerk in the county where the use occurs. The recording process provides the official notice of appropriation to subsequent users.

Over the years, court decisions have refined Oregon water law. Several of these refinements are particularly applicable to a salmon ranch operation. First, water may only be used as it is needed and may not be wasted. Second, the right to appropriate water may not be year-round but may be limited to the actual season when the water is used. Third, Oregon law makes a distinction between consumptive and non-consumptive uses. Any use of water that requires a diversion from its source is defined as a consumptive use. Salmon ranching, despite the fact that its source is defined as a consumptive use. Salmon ranching, despite the fact that it returns most of the water to its source, is a consumptive use. Fourth, even though a water right is "prior in time,"subsequent users must be respected. This means that one cannot change or extend one's use to the detriment of subsequent users. Fifth, water rights may be changed but only after a public hearing which determines if the change will interfere with others' rights.

H. Water Discharge Permit

Most hatchery operations require the discharge of water into public waters of the state. In Oregon, water quality standards are the responsibility of the Department of Environmental Quality. The Department issues National Pollutant Discharge Elimination System (NPDES) permits for the federal Environmental Protection Agency. This permit system was created by the Federal Water Pollution Control Act of 1972.

NPDES permits are required before wastes may be discharged from a commercial facility (which includes fish hatching and rearing facilities of a certain capacity or structure). "Wastes" means anything that tends to be detrimental to public health, wildlife, fish or other legitimate and beneficial used of water. Such changes may include changes in temperature, pH, dissolved or settleable solids, and dissolved oxygen content all of which a fish hatchery is capable of inducing. Oregon legislation concerning the NPDES permit is found in ORS 468.700, and OAR 340-45-005 to 340-45-070.

Applications must be submitted to the Department of Environmental Quality at least six months before the permit is needed. Once an application is complete, it is reviewed in terms of all applicable statutes, rules, regulations, and effluent guidelines of the State of Oregon and of the U.S. Environmental Protection Agency. These applications are circulated to the Oregon Department of Fish and Wildlife and other agencies for comment.

If a tentative decision in favor of issuing the permit is made, notice is given to the public of opportunities for comment. If either the applicant or an interested member of the public requests a public hearing, it will be held if the Director determines useful information may be produced. It is possible for a permit, once issued, to be modified due to new information and changing standards or conditions.

Salmon hatcheries which produce less than 20,000 pounds of salmon annually and whose input of feed is less than 5,000 pounds during its month of maximum feeding are exempt from the NPDES permit requirement. This may be particularly applicable to chum salmon operations due to the short rearing period and relatively small poundage of fry produced. In any case, a statement of exemption must be filed with the Department of Environmental Quality.

I. Dealer's Licenses

The operator must have a wholesale fish dealers license and poundage fees must be paid on the fish taken. Wholesale dealers licenses are obtained from the Department of Fish and Wildlife in accordance with a fee schedule listed at ORS 508.285.

J.Processing and Marketing: State Regulations

The Oregon Department of Agriculture regulations for sanitary conditions for food processing establishments apply to the processing of salmon. These regulations may be found in OAR 603-23-321 to 603-23-397. Furthermore, fresh fish and seafood products are subject to the Department's packing date labeling requirements found in OAR 603-23-565 to 603-23-585. The Department's Food Storage Sanitation standards may also apply (OAR 603-23-317).

In addition to these Department of Agriculture requirements, the processing and marketing operation is required to obtain a food fish canner license from the Department of Fish and Wildlife if any fish are canned (ORS 509.070 et. seq.). Additionally, the Department of Fish and Wildlife is authorized to regulated processing operations of both human fish food and of fish reduction facilities (for reduction into fish flour, fish meal, fish scrap, fertilizer, or fish oil) to prevent deterioration or waste of fish and to insure that processing is done in a wholesome and sanitary manner. The terms of this authorization are found at ORS 513.010.

K. Processing and Marketing: Federal Regulations

Because salmon is a food fish which might be consumed anywhere in the United States, the U.S. Food and Drug Administration's regulations on animal drugs are relevant to the salmon rancher. The Federal Food, Drug and Cosmetic Act requires that new animal drugs - including those for use on fish intended for human consumption - have FDA approval prior to their use. As a general rule, drug companies, rather than individual hatcheries, seek FDA approval. The use of an unapproved drug by a hatchery, however, would be the responsibility of the user. Should residues of such a drug be found in the returning salmon, they could be declared "Adulterated" and destroyed. As of this writing, malachite green (which has been used in some public hatcheries in the past) does not have FDA approval. Tolerances and regulations have been established, however, for tricaine maethanesulfate, oxytetracycline, and Diquat.

The use of vaccines is common in salmonid aquaculture, particularly for vibrosis. A vaccine, however, is classified a "biological product" by the 1913 Federal Serum-Toxin Act and, as such, is under the control of the U.S. Department of Agriculture. Its production requires a USDA license. The licensing procedure is similar to FDA approval of new animal drugs: the drug company, rather than the individual user, usually applies. To date, several firms have applied for vibrio vaccine licenses. Once a vaccine is licensed for sale, a hatchery may use it.

L. Summary

The following is from the ODFW source material for this discussion as relates to the impact of state and federal regulations on private salmon ranching.

"To prospective salmon ranchers, the variety and detail of the regulations, permits, and licenses to which a salmon ranch is subject may seem an insurmountable barrier. Moreover, there can be little doubt that the complexity of the regulatory process itself is somewhat of a constraint on the industry's development. This is not necessarily an improper or unnecessary situation. Salmon ranching is a complex proposition that affects coastal and fishery resources and may potentially affect commercial and recreational salmon fishing in unknown ways. The number of regulations which surround ocean ranching, in large measure, reflects public concern about the values and resources which are potentially affected. These are legitimate and important public concerns."

Part 3 - Issues

As a starting point for this discussion of issues, a pair of definitions is proposed:

An issue is a point in dispute.

A key issue is an important point in dispute.

This discussion puts forth a series of issues, in no particular order, that relate to private ocean ranching in Oregon. The identity of any one as a key issue is probably a function of perceptions and the eventual decisions as to what actions are appropriate. Each is discussed in terms of its background and significance and wherever possible a response resolving significant disputes is proposed.

Insofar as possible a brief judgemental comment is included that reflects how the resolution statement has been accepted by a significant majority of those who make up the advisory committee for this study or who have participated in the review of these drafts.

A. Operational Expectations - Chum Salmon Returns

Background - Chum salmon have several characteristics which were very attractive to those who were interested in ocean ranching at the time the enabling legislation was passed. They are not typically harvested by hook and line thus returns are mainly to the release site. Released fish are relatively small and easy to rear. From a marketing standpoint, they are not directly competitive to ocean harvested coho and chinook.

At the time of initial legislation, and now, chum salmon ocean ranching in Japan is a major success story. Annual harvests on the order of 50,000,000 fish are based almost entirely on juveniles released from hatcheries. Annual return rates have exceeded 2.5%. Part of the initial basis for instituting private ocean ranching in Oregon was the expectation that the Japanese returns could be matched. With this expectation and the special characteristics previously noted, permits for chum ranching were eagerly sought. Permits for releases in excess of 100 million juveniles were requested and granted to a number of companies.

However, the expectations were not fulfilled. Returns have only approached 0.1% and releases are now well under one million chum per year. Compounding the problem of low returns is the difficulty of obtaining eggs from small natural stocks. As a final straw, the fishermen have begun to discover ways of hooking chum salmon, removing even that apparent benefit.

Significance - (1) With chum not generally viable for this purpose, greater emphasis is placed on coho and chinook. (2) Some see this as a representative failure of ocean ranching, thus reducing general, and perhaps financial, support for the activity. (3) In addition, this failure has been especially disappointing to private ocean ranching supporters who saw chum salmon as something within the reach of individuals on a artisanal or hobby basis.

Proposed Consensus Response to this Issue - **Chum salmon are not now a significant part of private ocean ranching in Oregon and it is unlikely that much activity will take place to change this in the immediate future.**

Acceptance - This proposed consensus is generally accepted.

B. Absolute Fishery Contribution - Coho

Background - Unlike chum salmon, the expectation that private coho releases would contribute to the commercial and recreational fishery has always been a part of the justification for the private salmon program. Now, after some years of releases, the returns of coho from private hatchery plants have been significant. For instance, in the three years 1985-87, the total OPI coho catch averaged 662,000 of which 109,000 (16%) were from the private salmon ranches and 105,000 from natural spawners. In addition the private ranchers contributed and average of over 29,000 coho per year to fishermen north of the OPI. (See Table 2)

Significance - The significance of this contribution depends on perspective. The growers see it as proof of their contribution and the fishermen are generally glad for fish from any source. However, these fish are not considered an unmixed blessing to even the fishermen. There is some evidence that these coho, because they are released later than normal, are somewhat smaller than natural or public hatchery fish. Since fish management goals are typically defined in numbers rather than in pounds, it is possible that the coastal fishery will receive a larger share of smaller fish.

At first thought, the contribution outside of the OPI would appear to have little interest to the Oregon fishermen. However, the private growers generally feel that their increasing use of "south turning" coho will insure that a greater proportion of the private coho will be caught in the OPI in the future (though not necessarily in Oregon).

Also of concern to some is the belief that the presence of the "private" coho will somehow reduce the number of coho produced by natural spawners through increased competition for feed or through some form of genetic impacts. These aspects are discussed as separate issues.

Proposed Consensus Response to this Issue - **"Private" coho make a significant contribution to the fishery of the OPI area and some contributions to northern fisheries. These contributions are generally welcomed, even if not at full "face value".**

Acceptance - This proposed consensus is generally accepted as reserved above.

C. Relative Fishery Contribution and Its Determination- Coho

Background - For some, and for a variety of reasons, the relative contribution of coho to the fisheries from public, private and natural sources is of considerable interest. While this interest in the relative contributions may at times be excessive in our view, the related issues= of how the contribution is defined is of more valid concern to this assessment.

Tagging programs now in place provide relatively reliable information on the number of private hatchery fish that enter the harvest fishery both in and out of the OPI. Tagging programs applied to state hatchery fish were not specifically designed to provide similar information though this effort is beginning. Contributions from naturally spawning fish are estimated on a basis that seldom involves tagging at all.

However, despite a varying data base, estimates of the relative contributions (harvest and escapement)of each of these sources have been made in the Appendix based on methods developed by ODFW and the Pacific Fisheries Management Council (ODFW/PFMC). The estimates for coho are contained in the Appendix and are illustrated on Figures 16 and 17.

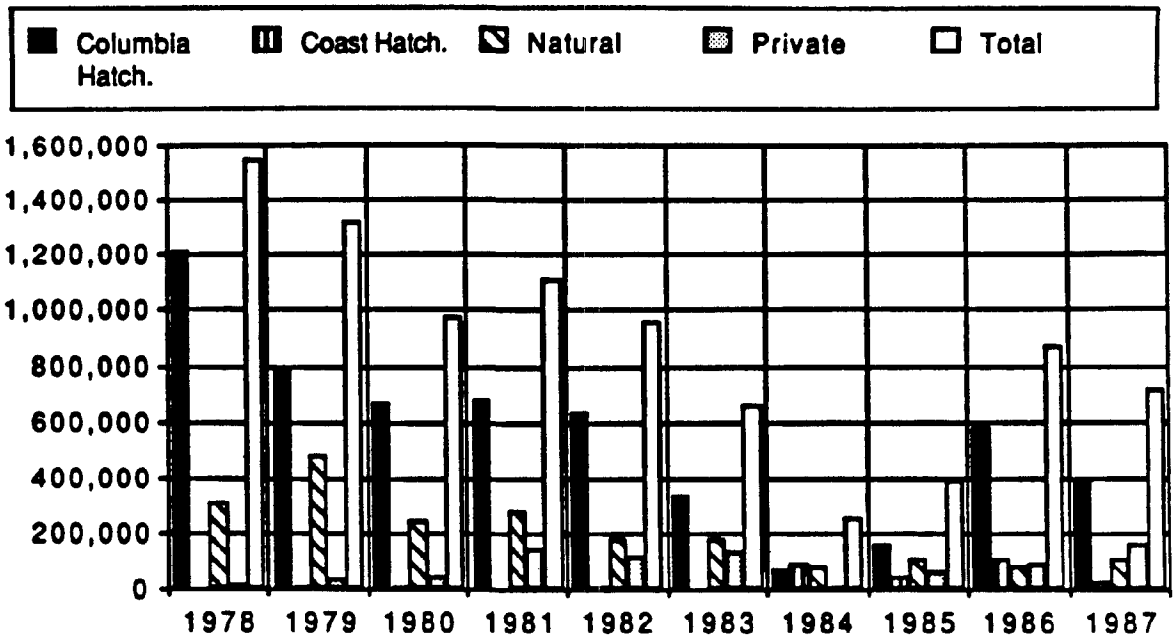

Figure 16
Sources of Coho in the Oregon Production Index Area Harvest
(Numbers of Fish)

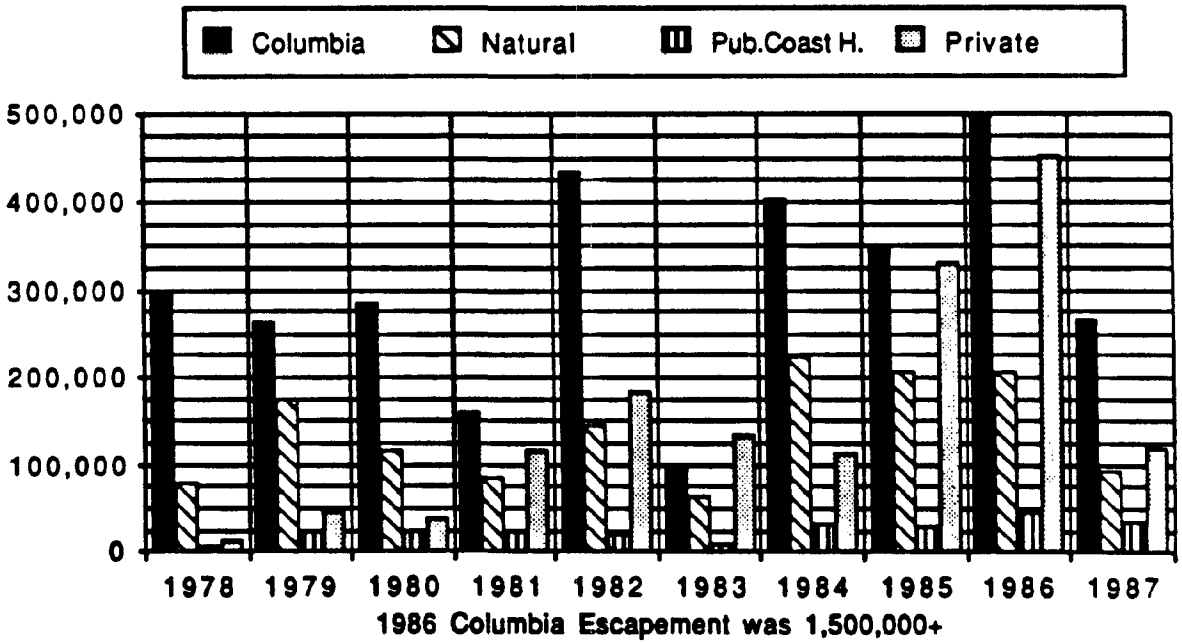

Figure 17
Escapement of Coho to Various Release Points, 1986 Columbia River
Escapement was 1,500,000+.
(Number of Fish)

The ODFW/PFMC method for calculating relative coho contributions for state hatcheries in total, natural spawners in the coastal rivers and private fish is as follows (The methodology can be followed on the Coho Balance Master Table in the Appendix):

1. The total harvest in the OPI is defined from catch statistics.

2. The total escapement is defined from catch statistics on the Columbia River (defined as escapement for these purposes), observation of spawning areas in approximately 1.3% of the coastal river length, private and public hatchery returns, and some freshwater harvest information (also defined as escapement for these purposes).

3. Private fish in the harvest are defined by tag recoveries.

4. Private fish are then deducted from the total catch and the total escapement.

5. A ratio between harvest and total (harvest + escapement) is defined.

6. The "natural" escapement plus harvest is defined by adding the freshwater catch and the estimated freshwater escapement (from the 1.3% sampling procedures.)

7. The ratio of 5 (above) is used to estimate the harvest of "natural" fish in the OPI.

8. The public hatchery harvest contribution is estimated by subtracting the private harvest (3, above) and the "natural" harvest (7, above) from the total OPI harvest (1, above).

This method is not fully satisfactory in several ways:

1. It ignores that some fish in the OPI are not "Oregon" fish.

2. It ignores that some "Oregon" fish are caught outside of the OPI.

(The method assumes the above balance.)

3. The counts of "natural" spawners are based on a small sample and using methods that, because they were designed for the gathering of other types of information, are not as statistically validas they could be.

The ODFW/PFMC method also makes the assumption that the harvest ratio (harvest versus total returns) for "natural" fish is the same as for "public" hatchery fish. While this assumption may or may not be true it is based on the unfortunate fact that ODFW has for years been forced to manage the "natural" and the hatchery fish as a mixed stock thus effectively forcing them towards either an excess return to the hatchery of public hatchery fish or an overharvest of "natural" fish.

As was indicated on Figures 16 and 17, we have extended the ODFW/PFMC methods to separate coastal and Columbia River hatcheries and escapements. This is done by assuming that the reported coastal hatchery returns have a related ocean harvest in the same proportion as assumed for all "non-private" coho returns (coastal and Columbia River).

Figure 18 describes the relationship between harvest and total survival for coho. (This is based on material found in the Coho Balance Master Table in the Appendix.)

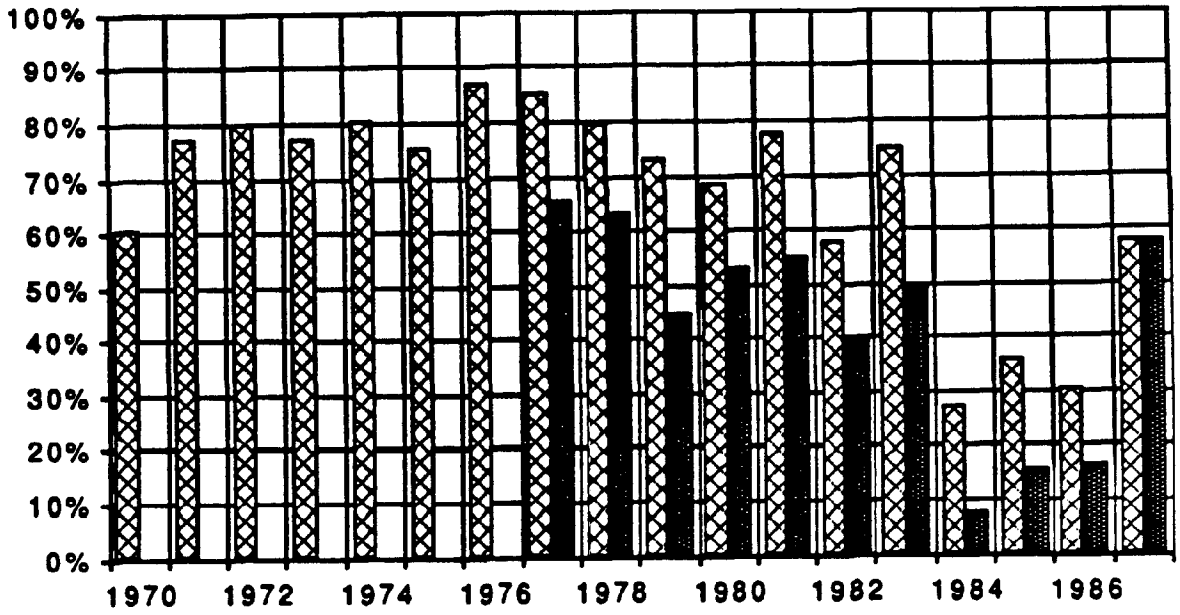

Figure 18
Catch Ratio for Coho from Public Coastal Hatcheries and Private Hatcheries.
(Expressed as OPI Harvest Divided by the (OPI Harvest + Escapement to Release Site))

Significance - the data presented here has significance in several areas.

1. Relative Contribution - Hatcheries (public and private combined) are contributing a larger part of the harvest even as the total harvest declines. Private hatcheries are contributing about a 109,000 coho each year (1985-7) or 16% of the 662,000 fish average harvest. This compares to an average contribution of 105,000 fish from Natural sources and 448,000 from public hatcheries. The number of fish contributed by the private hatcheries has trended up (though releases are declining) but the public hatchery and natural contributions are trending sharply down. This suggest that the private hatcheries are making a significant contribution to the fishery. It does not necessary "prove" that hatcheries are causing a decline in the "natural" contributions (though some may suggest that it does) and nor does it demonstrate that "private" hatcheries are more "harmful" than "public hatcheries".

2. Escapement - Trending of the natural coho escapement data indicates a slight increase in the 1972-87 period. Trending of the Total Hatchery coho escapement data indicates an increase in the 1970-87 period. (This increase is still apparent even if the unusual escapement of 1986 is discounted.) This upward trend may indicate that harvest management has been more effective in protecting escapement than it has the harvest.

3. Escapement -The percentage of "private" fish that escape the harvest has, until 1987, always been significantly higher than the escapement for "public" (natural and public hatchery) coho. Some have attributed this to the fisherman's preference for the larger "public" fish and/or the migratory patterns of the "private" fish which takes some of them out of the OPI. (See below relative to size.) The issue of migratory patterns may have had merit when Puget Sound coho where being used. It would appear to be less true now. Others insist that ODFW harvest management is directed at protecting the "private" fish. In 1987 the escapement values were the same for "public" and "private" fish. This has been attributed to the concept that recently the "private" fish are larger than before and that the fisherman seek them out more actively. (This belief is not supported by the data available elsewhere in this report. The average harvest size for coho at the return site has been relatively constant.) We tend to feel that this "identical" 1987 escapement may be "chance" and without major significance.

4. Quality of Data - The data that defines either harvest share or absolute numbers is weak in a number of areas with the best data being for the "private" coho. While there may have been ample reasons in the past for this, changes in approach are not a ODFG priority. However, in the assessment of private hatcheries this issue may not be especially significant except as it may demonstrate the difficulties of managing harvest in a mixed stock situation. In general, while we may wonder at the relative contribution and escapement of natural and public hatchery fish, we are relatively confident in the data presented for total harvest and private contribution and escapement are accurate.

5. ODFW Natural Harvest Data - Perhaps the issue of greatest concern in this discussion is that almost no data is available for the production fish of greatest concern,the natural spawner. Relative to natural fish, consider these factors:

By ODFW numbers, two private facilities put more coho into the OPI catch as a by product than all the coastal streams together (1985-87).

The driving force for management of the coastal coho fishery is the natural spawner escapement.

The natural combined catch and escapement is sharply down.

Significant tagging studies are not being done on natural coho.

Spawning counts (on 1.3% of the coastal rivers) are not satisfactory to ODFW and OSU scientists familiar with the methods.

Based on the above, greater effort in developing escapement and harvest data seems warranted.

There may be some connection between increased hatchery production and reduced natural contributions but this has not been quantified nor is it universally accepted. At the same time there is no compelling evidence that private hatcheries are more or less responsible than public hatcheries for the decline of natural contributions to the harvest.

Proposed Consensus Response to this Issue - **The private hatcheries are making a significant contribution to coho harvest and that contribution is generally increasing. The naturally spawning coho are contributing about the same today as the private hatcheries but their contribution is well down from the past. The public hatcheries are contributing about 65% of the harvest today but their contribution is also well down from the past. While harvests are declining, escapements appear to be fairly constant. The impact of hatcheries on natural production is of concern to some.**

Acceptance - This proposed consensus is generally accepted as reserved above.

D. Fishery Contribution - Chinook

Background - Adult chinook returns to the private hatcheries exceeded 15,000 for the first time in 1985 when the 35,000 chinook were recaptured by the private facilities. In 1986 the return to the private hatcheries was 70,000 fish while the total fishery contribution in 1986 peaked at 135,000 fish and declined to 39,000 in 1987. In those two years the private contribution to the Oregon fishery was 13.3% and 3.5% respectively. (see Figure 14)

Like the coho, chinook return percentages were markedly improved with the passing of "El Nino" though part of this improvement, as with the coho, almost certainly relates to improvements in release strategies. Stock selection, specifically the "south turning" Rouge River Spring Chinook (RRSC) also is contributing to better hatchery returns and, in some opinions, the availability of these fish for

Oregon harvest. On this last point however, there is disagreement by those who feel that the bulk of the returns are before the fishing season and thus less subject to sports and commercial harvest.

Significance - The significance of this contribution depends on perspective and the long-term proof that the use of the RRSC will provide a significant contribution to the ocean fishery.

1. The private growers would like to insure returns above a certain level or, failing that, a consistent, reasonable share of the adult survival. (Their 1986-87 share was 51%.)

2. Many, but not all, fishermen would like to see the total numbers of chinook available to them increase with Oregon fishermen wanting the highest possible share of the total ocean harvest. This tends to favor stock selection to increase Oregon harvest vulnerability.

3. Some would prefer that the hatchery returns be limited to those required to provide eggs for release and that the operations not be based on private ocean ranching.

4. Some believe that these "private" fish have a negitive impact on natural spawner production and thus their net contribution is less than tagging studies indicate.

Proposed Consensus Response to this Issue - **It is clear that "private" chinook have made a contribution to the Oregon fishery with a potential to exceed the coho contribution. As the use of the RRSC is a new undertaking in the two larger hatcheries, its impact is not clear. The impact of hatcheries on natural production is of concern to some.**

Acceptance - This proposed consensus is generally accepted as reserved above.

E. Market Competition - Rogue River Spring Chinook

Background - Commercial trollers in Oregon waters have found that the spring chinook caught early in the season bring especially high prices. Some feel that the release of Rogue River Spring Chinook (RRSC) by the private growers is a threat to these high prices because they begin returning to the release sites before fishing season starts and thus reduce buyer interest in the troll caught chinook that will come on the market later.

Significance - The significance of this depends on perspective.

Some trollers believe that they receive less per pound for these fish because of market factors. However, if one presumes that there is enough overlap between the fishing season and the RRSC returns then the number of chinook available to the troller may increase thus offsetting a price reduction. This is especially true if the season is opened earlier, thus insuring the opportunity for troller participation the harvest.

The consumer may benefit from the competition by being able to buy chinook for less and for a longer period.

The Oregon economy may benefit by having more quality product to sell elsewhere and by reducing the import of fish from other areas in the off season.

The growers simply do not agree that this occurs and note that the RRSC return to private hatcheries is typically from May 1 to August 30 with the peak being in June and July (during the normal fishing season).

Proposed Consensus Response to this Issue- **The use of Rogue River Spring Chinook by private growers may have some impact the commercial fisherman's market for early harvest chinook. This is viewed by some as being of benefit to the consumer and the state economy. Options for minimizing the impact on the trollers may be available.**

Acceptance - This proposed consensus is generally accepted as reserved above.

F. Market Competition - Private Salmon

(The above issue is a narrow one, relating only to the early run RRSC. The broader and more important issue is that of market competion between all privately ranched oregon salmon and the Oregon commercial harvest. That is the subject of this discussion.)

Background - Though chinook returns to private hatcheries are now fairly small as compared to the commercial harvest, coho returns to private hatcheries are significant as compared to the commercial coho harvest in Oregon and of varying significance as compared to the coastwide commercial coastal troll harvest (US incl. Alaska & Canada) as indicated (numbers of fish and % of Coastwide Harvest):

	Coastwide Coastal Troll Coho Catch	Oregon Coastal Troll Coho Catch	Private Hatchery Coho Harvest*
1987	4,390,000	355,000-8%	119,300-3%
1986	6,877,000	440,000-6%	453,700-7%
1985	4,139,000	84,000-2%	332,000-8%

* Not all of the fish harvested by the ocean ranchers are sold as food. Some are held to maturity for the production of eggs.

The 1988 private releases are generally down from peak previous years and the private harvest proportions in the next few years should be less than that shown above.

In 1987 the US imported 25 million pound of fresh salmon, with over 14 million pounds being from pen farm operations in Norway. (PFMC, "1987 Ocean Salmon Fisheries", Page IV-2) This compares to an average return to Oregon's private hatcheries (all species) of 2.1 million pounds (averaged 1985-87). The world production of farmed salmon in 1987 was 215 million pouns with the United States producing only 5.5 million pounds. The world production of farmed salmon in 1990 is projected to be 500 million pouns with the United States projected to produceonly 17 million pounds. ("Aquaculture and Capture Fisheries: Impacts on US Seafood Markets", NOAA/NMFS April 1988.) Under the future "Maximum Scenario" defined elsewhere in this assessment, the total of salmon caught in Oregon and harvested by the private growers will just exceed 18 million pounds of which 50% would be private.

Based on the above information it is clear that, at current private harvest levels, the private hatchery fish make up about the same share of the market place as the Oregon ocean troll coho catch. However, neither is significant as compared to the total coastal harvest (5-6%) or the imports (less than 10%). Projections would suggest that <u>all</u> US salmon farm production (pens and ocean ranching) is unlikely to approach 4% of the world salmon farm production.

A recent study considering the impact of salmon aquaculture says "dockside prices received by US fishermen are lower than they would be otherwise...by competition from commercial aquaculture products. By the same token, US consumers enjoy the benefits of lower salmon prices that are the result of unrestricted foreign import supplies." ("Aquaculture and Capture Fisheries: Impacts on US Seafood Markets", NOAA/NMFS April 1988.) The same document notes the relatively tiny significance of US salmon production in impacting prices.

Significance - The significance of this depends on perspective. If we assume that the level of production defines price then we can describe the market impact of increased private salmon ranching in Oregon as follows:

Commercial salmon farming has probably caused the commercial troller to receive less per pound for his product. However, Oregon's private production is a minute factor as compared to production in the rest of the world.

The price impact of Oregon's private production could well be offset by the higher total pounds of fish available to the fishermen due to private operations.

The consumer benefits from the commercial competition by being able to buy salmon for less and for a longer period period but, once again, Oregon's private production playsonly a small role in this.

The Oregon economy may benefit by having more quality product to sell elsewhere and by reducing the import of fish from other areas.

In any case, the scale of US or Oregon production (catch and harvest) is small as compared to the rest of the world and getting smaller. This trend should be of great concern.

Proposed Consensus Response to this Issue - **On a world scale (or even within the US), private salmon ranching in Oregon is not a significant determinate of the price of salmon. At a local level there may be minor.impacts but thiese could be mitigated by. better total local harvest.**

Acceptance - This proposed consensus is generally accepted as reserved above.

G. Attitudes of Oregon's Salmon Fishing Industry to Private Salmon Ranching Initially and Today.

Background - Much of the initial opposition to legislation permitting ocean ranching came from Oregon's salmon fishing industry. This intensified when coho and chinook were added to the species that could be ranched. The opposition was based on a whole range of scientific, political, and economic concerns. Today, some say that this opposition has been somewhat reduced. That today's industry is more clearly defined than it once was (ie, three active operations) is probably reflected in such changes of attitudes as may have occurred.

Significance - The future success of private salmon ranching in Oregon depends to some degree on the attitudes of Oregon's salmon fishing industry. Exactly how much is subject to disagreement but it is fair to say that strong support or strong opposition by an industry of this importance will be significant.

Proposed Consensus Response to this Issue - This has no clearly defined consensus with the views ranging from:

Both the commercial and recreational sectors of Oregon's salmon fishing industry now strongly support private salmon ranching. This is in contrast with their earlier view.

to

Both the commercial and recreational sectors of Oregon's salmon fishing industry now strongly oppose private salmon ranching. This is similar to their earlier view.

We tend to believe that the underlying fishing industry support for private salmon ranching has improved. However, that there is no clear consensus is heavily a function of perspectives and, perhaps, individual personality conflicts. This will be further considered in Part 4 of this Assessment but this should be of concern to the private salmon ranching industry.

of the returning fish of private origin. ODFW has the capability to approach, as a long term average, some specific public/private division objective. The propriety of such action is a separate question.

Acceptance - This proposed consensus is generally accepted.

I. The "Fair Rent" Concept

Background - Recent attention has focused on the concept that some form of stability could be imparted to the private/public balance by establishing some way to economically balance returns of the fishery related to private ocean ranching.

For example, one group may say that the private growers should pay to use the ocean's pasture and that this payment should be in the form of the fish that the public catches and perhaps some extra payment for the fish that are harvested by the private growers. (Such as the 5 cent a pound tax on coho and chinook now collected by the state.) Carrying this further, this same group could suggest that payment should be made to the state if the growers somehow manage to harvest more than a predetermined proportion of "private" fish. **This is Plan A.**

On the other hand, another group may say that the private growers should be paid for the fish that the "public" are able to harvest and that if they catch too large a proportion, they should compensate the private growers by some extra measure. Finally, they suggest that payment for grazing rights is inappropriate as there is no well defined alternative use and that their use of the pasture harms no one. **This is Plan B.**

A middle ground alternative to either plan has also been suggested involving both plans with such features as a predefined sharing level for the fish and long term averaging of economic impacts. **This is Plan C** and for our purposes this will be the **fair rent concept.**

Significance -The problem with Plan C is that while the general concept is attractive, it could be difficult to reach agreement on the numbers, the procedures and the regulatory requirements. However, if this can be accomplished, this may be a workable answer to keeping the private salmon ranchers, the fishermen and the consumers happy.

The fundamental parts of this concept are:

1. A "private/public" split of the returning private salmon hatchery fish would be defined that would say **"An appropriate split is X% private and the rest public."**

2. A method of providing compensation to the state would be defined such as **"If more than X% enters the private hatcheries, they will pay the state $Y/pound".**

3. A method of providing compensation to the private salmon ranchers would be defined such as **"If less than X% enters the private hatcheries, the state will pay the growers $Z/pound".**

There are also a number of secondary issues that might be part of the concept:

1. A method for balancing returns between the private growers would be defined such as **"If one grower gets more than X% and another less, appropriate transfers of payment will be made."**

2. The planting levels should be stabilized so as to protect fishermen and harvest managers from harvest rate changes beyond what nature already imposes, such as **"As a condition of participation, each grower will commit to releasing at least"W" smolts per year of given characteristics."**

3. The state as a "partner" may wish to define where the money comes from and what the limits are, such as **"In no case shall the state commit to more than "U" over a 5 year period, with this money to be derived from a license charge of "V" and appropriation from the general fund not to exceed $Q per pound of private hatchery fish caught in the public harvest".** ("Q" is some amount that would reflect part of the added direct state revenue.)

4. Some form of averaging liabilities may be needed, such as **"Payments for annual obligations may be made over a three year period with a balancing of credits and liabilities."**

It should be noted that no part of this discussion has suggested that the state undertake a specific management program with the objective being to stay as close as possible to the " X%" split. Typically the private growers feel that is a decision for the state and need not be part of an agreement. However, it is clear that the specific conditions as defined by X, Y, Z, W, U, V, and Q could have the effect of forcing harvest management that would optimize the state's obligations. Thus the harvest management issue is part of the Fair Rent Concept.

Proposed Consensus Response to this Issue - **The Fair Rent Concept offers an opportunity to improve the stability of private salmon ranching and increase its contribution to the ocean fishery. However, the challenge of expanding the concept into a quantified and enforceable agreement that will find adequate acceptance is a major one. Success is not insured by agreement in concept.**

J. Free Market/Full Ownership Concept

Background - The idea that resources are owned by someone (or some government) is fundamental to life on land. However, some 400 years ago a Dutch lawyer, Hugo Grotius, decided that unlike land resources, the resources of the sea could not be "exhausted" and thus a definition of ownership was not necessary. In this he convinced everyone else and, for this reason, our ocean fishery has been built around common ownership or what Crutchfield, Keen and many others have described as "The Tragedy of the Commons".....Fish belong to everyone, thus they belong to no one. If one is to believe these people, the determination of who owns a fish is the beginning of a rational basis for making best use of that fish and for preserving that resource. This grows from the idea that the best way to develop and protect the resources (rather than letting everyone take what they can until the resource is destroyed) is to define ownership and let the owners protect the resource. (This is why the government sells timber and grazing rights.)

This view is not universally popular in fishing communities and for this reason supporters are reluctant to define the fair rent concept in ownership terms. However, the Fair Rent Concept has at its core the idea that there should be some form of ownership rights for each part of the fishery resource. This is not far from the idea that the resources should be sold to the highest bidder (in a "Free Market") to benefit the general public. Thus as one considers the Fair Market Concept one might also consider the views of Elmer Keen, et al.

Significance - It may be that this has little significance to our immediate concerns. However, it may well be that the existence of private salmon ranching in Oregon will trigger the serious consideration of a new way to manage all of the salmon resource in Oregon. If this happens this discussion will have significance.

Proposed Consensus Response to this Issue - **A Free Market/Full Ownership Concept could be a viable method for providing stability to private salmon ranching and it is, at least in theory, a better approach than a "fair rent" system based on special interest negotiations. However, this may be too small a problem to be solved by so large a change in public policy. Still, as our present systems for distribution of this resource is satisfying few and providing little effective protection, a look at alternatives in this direction is easily justified.**

Acceptance - This proposed consensus is generally accepted but with little real hope of success.

Required reading: "Ownership and Productivity of Marine Fishery Resources, An Essay on the Resolution of Conflict in the Use of the Ocean Pastures." by Elmer A. Keen, McDonald and Woodward Publishing Company, Box 10308, Blacksburg, Virginia 24062-0308.

K. Carrying Capacity

Background - Many of the initial discussions of private ocean ranching revolved around the question of the nature's ability to support the smolts planted as part of this program. The general acceptance of this as a problem was a basis for requiring that planting strategies insure that the smolts would go immediately to sea and not compete in the rivers and estuaries for feed. This leaves the issue of the ocean's carrying capacity.

The "Maximum Operations" Scenario, described elsewhere suggests total survival of "private" adult fish would be 1.3 million coho and 0.96 million chinook as compared to the 200,000 coho and chinook (each) per year that is reflective of a "Status Quo".

The ODFW Coho Plan puts forth a 2.5 million harvest and escapement goal with apparent confidence that the ocean isn't limiting. Washington's Salmon planning in 1976 was based on increasing their harvest by 4.7 million fish. Japan has expanded production to over 40 million fish and the Alaskan harvest occasionally exceeds 100 million.

The issue is complicated by the varying nature of the ocean's localized ability to support fish as illustrated by the recent El Nino phenomenon.

Significance - The significance of this as a question relative to the ocean's carrying capacity revolves around the number of fish planted and the number of adults that survive and eventually return to graze in the context of all salmon that enter the North Pacific.

Definitive answers on ocean carrying capacity that are generally accepted and based on creditable scientific analysis do not appear to be available. Opinions from all levels of analysis abound and this study will not generate new answers.

Proposed Consensus Response to this Issue - **Release strategies have eliminated much of the concern over river carrying capacity as relates to smolts for any of the "Operating Scenarios". (The straying of adults into the rivers is a different issue.) At any "Operating Scenarios" except the maximum, concerns for the ocean's carrying capacity should be small. As the maximum scenario is approached caution may be appropriate but only within the framework of all of the North Pacific salmon programs.**

Acceptance - This proposed consensus is generally accepted.

L. The Stability of the Ocean Ranching Permits (as relates to State actions)

Background - There are those who have expressed concern over the authority that ODFW has relative to the modification and withdrawal of the ocean ranching permits. They consider that this authority reduces the ranchers ability to plan ahead and/or seek out long term financing. That this authority exists.is generally conceded as is the perception that ODFW's willingness to use it is a function of political and special interest pressures.

Further, the periodic introduction of legislation "unfriendly" to ocean ranching has raised concerns that ODFW will be forced into a actions even more threatening to the permits than now. Similarly, the introduction of legislation "friendly" to ocean ranching has mobilized various interest groups. Legislation as put forth, pro and con, is typically defended on scientific grounds but often would appear to be motivated by an underlying bias for or against ocean ranching. One example would be the introduction of legislation to require the tagging of all smolts released from private hatcheries as

compared to the present practice of tagging only part of the fish (4 to 16% in 1988). The results of a 100% tagging program would be to greatly increase the cost of private and ODFW operations with little, improvement in catch information. Thus the real impact of the proposal would be to reduce the chances for the survival of private ocean ranching.

History has shown that ODFW does not casually consider the withdrawal of permits. In the 16 years since the first permit was issued, all withdrawals have been voluntary and primarily related to the transfer of sites. This would suggest some stability for these permits, at least as relates to withdrawal by State action.

A category of permit modification does exist, however, that is of concern to private salmon ranchers. Within their authority to regulate these permits, ODFW can and has taken actions that are viewed as destabilizing by the industry. Some general examples would be in the control exerted over egg supplies, the release strategies and the management of harvest. Some of these technical issues are gradually being brought under control as both ODFW and the private hatcheries gain experience. Others, however, continue to surface as illustrated by the recent actions relative to the Coos Basin Salmon Plan. (See Section R of this part of this assessment.)

A factor that may be viewed as stabilizing is the current moratorium on new permits. By limiting entry, the number of new concerns are reduced. At this point in time, a permit in hand has added value in that there are so few of them.

Action that would be viewed as destabilizing is action that would make transfers of permits subject to more restrictions than now found in the regulations. (Such action is being considered.)

Probably at the heart of this issue is the language of the ocean ranching legislation that requires that ODFW make many of its decisions based on "Best Public Interest". Jim Lichatowich formerly of ODFW said, on one issue "Unfortunately there is no common scale that can weigh the cost and benefits and clearly dictate a proper decision." (Agenda Item Summary dated 2/9/87, re: Oregon Aqua-Foods operations relative to wild coho salmon in the Yaquina River.) We believe that quote to broadly be true.

Significance - Clearly it is important to the remaining ocean ranching firms that their permits be viewed as a property that will not be withdrawn or significantly modified for so long as they make a reasonable attempt to comply with their conditions. The stronger the assurances the more likely they are to continue to operate.

However, we should keep sight of the fact that the stability of private ocean ranching in total depends on a number of factors that are very important such as: improved and consistent returns, reduced harvest conflicts, operating costs and the market place. These may be better areas to focus on.

Proposed Consensus Response to this Issue - **Ocean Ranching Coho/Chinook Permits are relatively stable at this time in the sense that withdrawals are unlikely and modifications growing out of regulatory actions are less disruptive to operations than in the past. Legislative or regulatory changes can and do impact this situation.**

Acceptance - This proposed consensus is generally accepted.

M. Genetic Implications of Private Salmon Ranching in Oregon

Background - Often it seems that a person's position on ocean ranching can be determined by their view of the genetic implications of private salmon ranching. If they see little to be concerned with, they generally support it. If they are very concerned, they are generally opposed. What is surprising is that they frequently differentiate between private ranching and public hatchery release programs and assume that these are dissimilar activities and have different potential impacts.

The fact is there are few qualified to really understand the issue at a level that makes specific decisions possible and these few do not always agree. Furthermore, even those who have the requisite

theoretical knowledge, seldom have at hand the data necessary to evaluate specific situations and as a result they seldom provide comfort to laymen seeking useful guidence. Still in an attempt to clearify some issues, specific to this appraisal, we contacted three experts familiar with ocean ranching practices and salmon resource management issues in Oregon: Professor James Lannan from Oregon State University, and Jack McIntyre and John Emler from the U.S. Fish and Wildlife Service. We asked them to consider these questions as relates to the "Expanded Scenario":

a. In the year 2000, what impacts (good and bad) do you expect to see on "native" salmon in the "In-system" drainages that can be reasonably ascribed to the "private" fish?

b. In the year 2000, what impacts do you expect to see on the total coastal "native" salmon population that can be reasonably ascribed to the "private" fish?

c. How will the above impacts differ from impacts from the parallel operations of ODFW coastal hatcheries? How do these compare to past ODFW planting operations in the coastal rivers.

d. If the "Expanded Operations" scenario were to be suddenly terminated, would you expect the impacts to be reversed? How long might that take?

e. Would your answers to the above be significantly improved by information that could be collected in 12 months? 5 years? 20 years? What economic resources would need be programmed to collect this information?

f. What is the worst things you might imagine (growing out of the "genetic implications") that could result from the "Expanded Operations" scenario.

g. Can you relate some level of genetic risk to some level of economic benefit?

h. Are there strategies that would seem appropriate to private ocean ranching operations that could significantly reduce negative impacts?

i. Are there technical (genetic) breakthroughs that could benefit salmon ranching that might be available in the next 10 years? This might include such things as the "genetic engineering" of modified animals or "better ways to quantify genetic implications" or "better methods to use genetic traits to reduce impacts".

j. How well informed in genetic questions are the policy makers (public agency, fishermen, private citizens and salmon ranchers) involved in the private salmon ranching issue?

After they had considered these questions we discussed with each what they felt were viable general responses to the issues raised. The following is a brief summary of their concerns, points of agreement and suggestions for planning for the future of ocean ranching in Oregon.

The experts agree that, in general, the practice of direct release into the sea by private ranching operations results in less of an impact on aquatic resources than public hatcheries which release fish into freshwater stream and rivers. They also agreed that there are associated, but theoretically controllable, genetic and ecological risks associated with ocean releases. While there appears to be sufficient data to support the conclusion that direct sea releases result in higher incidences of straying, the genetic risks associated with straying are uncertain given the current lack of inventory of the genetic resources for both native and hatchery populations. Thus any assessment of genetic risks must be based upon conjecture.

On one side is the opinion that reproductive isolation of small breeding populations increases the probability of losing genetic resources and increases the vulnerability of the stock to environmental changes. This position supports increasing the size of the gene pool by encouraging the production of more fish to enhance the stability of the salmon population. It accepts straying as a normal event and does not ignore the possibility that managed introgression of wild populations could be beneficial in some cases. On the other side, is the view that the risk of catastrophic loss of genetic resources as

the result of large releases of hatchery produced fish may be great. This opinion supports a conservative program of increased hatchery production until more is known in order to avoid major genetic changes in indigenous salmon populations.

While both sides generally agree that conservative management is appropriate, the definition of "conservative" is obscure in the absence of management goals. Preservation of genetically depleted resources maybe contrary to conservation goals. Consequently, knowledge of the genetic history of both natural and hatchery populations is a prerequisite to conservative management. For example, it is important to know if loss of genetic resources is a result of over fishing, loss of reproductive habitat, or some other environmental factor. In general, the probability of negative impacts resulting from the introgression would be greater for diverse stocks and less for genetically depleted stocks. Conversely, the probability of beneficial introgression would be greater for stocks which have experienced genetic depletion and less for more genetically diverse resources.

Both sides agree that it is possible to reverse minor genetic disruptions over 2-3 generations. Technically, major alterations can also be reversed as long as the genetic resources are available. Hatchery programs are not necessarily a threat to extinction of genetic resources and therefore do not pose a threat in terms of irreversible impacts. The possibility of hatchery programs resulting in the depletion of native stocks is not denied, however this is not the same as extinction. While one side may argue that a depleted population is unlikely to be restored, technically it is feasible as long as genetic extinction has not occurred. Obviously, the first step in protecting against this possibility is to know what the resources are. Little has been done to catalogue genetic traits and make any sort of an appraisal of potential risks on native species. This lack of data makes it difficult to predict costs and benefits of hatchery programs including private ranching. An acceptable level of straying is probably in the 1-2% range but this should be examined on a case by case basis. At this level both sides agree that there could be a net benefit.

The capability of the ocean environment to support increased populations is also at issue. One side believes strongly that there is sufficient, applicable evidence from salmon release programs in Asia to dispel fears that we are about to tip the scales in terms of the grazing capacity of the ocean waters. This view is based on increasing rates of returns with increasingly larger release programs and the view that even the most ambitious ranching programs in Oregon are but a drop in the bucket. The other side feels that there is insufficient evidence but that more evidence is being collected to suggest that there is reason to be concerned.

Both suggest that the only prudent course is a conservative one and that it would be difficult if not impossible to accurately measure the capacity of the Pacific Ocean. In response to this, there is the extreme view that one should not do anything until more facts are known. On the other side of the conservative posture is the view that a controlled program of increasing releases and monitoring is the preferred approach. What is clear is that other producing countries and states do not necessarily share this same level of concern. From a geneticists standpoint, the concern on this issue is that of large releases of hatchery produced fish being able to outcompete wild stocks for limited resources if such limitations actually exist. The available statistics are questionable in most cases. Some populations have been intensively observed, while others have not been monitored at all.

The geneticists generally agree that there are techniques which could and should be employed in all hatchery programs to maintain the genetic quality of the fish produced. Any effort to effectively manipulate or preserve a genetic population requires knowledge of the genetic history of that population. This is often referred to as pedigree or lineage. Geneticists advocate collecting such information in order to provide an effective tool for both monitoring effects of various practices as well as a altering or preserving specific populations. There is general agreement that intentional as well as unintentional genetic alteration takes place through aquaculture, given methods used for selecting fish for spawning and the rearing environments of the hatcheries themselves. However, genetic engineering of fish on a production scale is a long way from technical and financial reality and therefore should not be an issue of concern.

There is general agreement that the genetic implications of harvest management are more profound than the genetic implication of hatchery management. Genetics is oftentimes a smokescreen which

disguises more immediate and perhaps more important issues. It is essential to define goals in order to assess genetic, or other risks, within an established context. Without such goals it is impossible to develop management practices, design research programs and allocate production responsibilities and opportunities.

They generally agree that much more could be done to reduce risks given the knowledge which exists, and more importantly they agreed that a more rigorous data collection program would be of great benefit.

Proposed Consensus Response to this Issue - **The genetic implications of private salmon ranching in Oregon as expressed by the Expanded Operations scenario can, at best, be seen only dimly and it is unlikely that a clearer vision will be available in the short-term. While caution is reasonably advised at this point, even the meaning of caution is unclear. There is general agreement that the genetic implications of harvest management are more profound than the genetic implications of hatchery managemement. In general, the Expanded Operation Scenario would appear to carry no greater risk than any other hatchery program in the state assuming the same number of fish are produced.**

Acceptance - On review by others involved in these issues the above discussion was generally accepted but with a number of reservations to suggest that practices in both ODFW and the private facilities are more sensitive to genetic impact concerns than is generally appreciated by those not involved in the operation of the hatchery facilities. Dispite the limitations expressed above, conclusions are drawn and decisions made that are based on genetic understanding and implications.

N. The Straying of Returning Adults

Background - Straying is a term that describes what happens when salmon reared and acclimatized at a particular location, don't return to that location to spawn. There is some straying in all salmon stocks but it would appear that the privately reared fish are straying a little more than the public hatchery fish and, in some opinions, a great deal more than "natural" stocks. As straying has significance beyond economic losses, and as it may occur in private hatcheries more than in other situations it is worth discussing in this context. Two aspects are of greatest concern to those interested in the ocean harvest.

1. The first is in how much natural production could be decreased by straying. There are those who believe that the straying of fish into the rivers will so impact the natural spawning process that the "gains" in the ocean fishery will be offset in large degree by "losses" of natural fish.

2. The second area of concern to some is their belief that as straying depresses natural stocks in nearby streams, the ODFW management stratagies will be calabrated by low runs in those streams and the entire harvest allocations will be reduced.

(ODFW's staff theorized that the OAF operations at Newport were the cause of depressed coho runs in nearby streams in 1986 in a review of OAF operations. That their operations were significant in the decline was strongly disputed by OAF and in an attempt to better understand what has happened ODFW and OAF are undertaking investigations. At the same time OAF and other private salmon ranchers are working on stratagies to decrease straying.)

These are reasonable concerns. However, how important they are to the total harvest relates to a number of factors including the scale of private salmon ranching operations, the improvements in technology and management decisions by ODFW. We will attempt to quantify the range of possibilities elsewhere.

Two types of adult straying are known to take place in the major private facilities; (1) in-system straying which is defined as straying into the specific river system that the hatchery is on, and (2) out-of-system straying that involves fish entering other river systems or even other hatcheries. While the former is

typically much larger than the latter, the implications of out-of-system straying can differ under some conditions. For example, the Yaquina system (location of the OAF facility) is managed as a "B" river, a river that is managed "for wild plus hatchery fish". It has been proposed that this be redesignated as a "C" river, a river that is managed "exclusively for hatchery fish". (A "A" is a river managed "exclusively for wild fish".) Under a B designation the control of in-system straying of hatchery fish is an important concern. Under a C designation, in-system straying is much less important. However, if the result of changing the Yaquina to a C system was to greatly increase releases, the question of out-of-system straying remains a concern.

Some of the technical aspects of straying should be discussed.

1. One reason that some added "private" straying may have occurred recently is a strategy employed on a experimental basis by private growers to improve returns by releasing fish from barges well offshore. This allows them to avoid predation nearshore and to insure that the small fish will not compete with native stocks. It may also be that offshore release may increase straying. (An internal ODFW memo in early 1988 concluded that fish released offshore had a higher probability (2.5 times) of straying than fish released onshore. However, preliminary indications in research by Dr. William McNeil suggests that this straying may be related to fish transported in tanks on the barge decks. Fish transported to offshore release sites in pens appear to stray no more than onshore releases.)

2. Another reason that straying has occurred is that the return site may not be a satisfactory one (either generally or at a particular time).

3. Other reasons for straying include inappropriate release sizes, inadequate holding time and perhaps release timing. In any case straying has occurred.

The scale of straying is of significance but difficult to quantify and even more difficult to project. However, some investigators have suggested that 3-5% straying of adults has occurred under conditions found in the early 1980's. Recent developments in release strategies may serve to reduce the numbers of strays significantly and the 1-2% described in the genetics issue discussion may be possible. However, there still remains the question of "1-2%" of what?

Significance - That salmon stray is of some direct economic importance to the growers as these represent "lost" fish. However, the greater general significance of straying private hatchery fish is in their impact on other salmon in terms of genetic impacts, competition, disease transmission and numerical contribution to depressed natural stocks. To the fisherman however, it may be that the greatest concern is in how the interaction of out-of-system strays and ODFW management decisions will impact the harvest.

Both the degree of straying and the impact is site and stock specific, large numbers of straying fish in a stream with a small natural return will have a greater impact than the opposite proportions. Straying spring returns to a stream that will not support their survival through the summer will have little impact of fall spawning fish. It may be that to discuss the universe of possibilities will obscure that within the specific conditions we now encounter the possibilities are more limited. (ie, three release sites, one major chinook stock and two major coho stocks)

Proposed Consensus Response to this Issue - **The private hatchery fish will stray from their acclimatization sites as will all salmon stocks. However, evidence suggest that straying may be greater from some release strategies and thus should be of special concern. Improved release strategies should improve past performance but at, perhaps, some cost. Quantification of the degree of straying would be useful in defining damages but at this time sufficient hard data is not available. Damages or benefits may accrue from straying and they are best defined on a case by case basis.**

Acceptance - This proposed consensus is generally accepted.

O. Private Salmon Ranching and the State's Wild Fish Policies (and their predecessors)

Many of the othre issues discussed here touch on "Wild" fish questions. However, two other elements are worth noting breifly.

Background :

Harvest Rates - In the beginning it was recognized that wild fish policies that restricted all coastal harvest to escapement levels that were appropriate to "wild" fish would benefit private salmon ranching. These policies had the effect of reducing harvest levels from about 80%, appropriate to hatchery production, to 50% which would, in theory let more fish return to the private operation

In practice, ocean harvest percentages on "private" fish have varied from about 22% to over 68% and it is apparent that this wild fish/private fish harvest relationship has not produced exactly what was anticipated.

Wild Egg Taking - In the beginning, the regulations were very restrictive regarding the taking of eggs from wild fish for private salmon ranching, especially for coho and chinook. This was based on the underlying view that ocean ranched salmon should be from stocks that are very different from native stocks. Over the years this view changed and ODFW's regulations required that the private growers move towards the use of stocks that are the same as or similar to, the "wild" stocks in their river system. However, eggs could only be taken from surplus stocks by ODFW and replacement of the "natural production", by planting progeny smolts back into the wild populations was required by legislation passed in 1981. Since the original definition of where eggs could be taken from was "surplus stocks", mitigation seems unnecessary and perhaps even undesirable. However, this is the law.

Significance - The point of the above discussion is to suggest that there are contradictory aspects of "wild fish" policies that are still to be resolved.

Proposed Consensus Response to this Issue - **The state's wild fish policies have the potential for providing stability to the private hatcheries operations but this has not been very effective in practice. These same policies have shifted reflecting changing views by the legislature and ODFW.**

Acceptance - This proposed consensus is generally accepted.

P. An Economic Comparison of Scenarios

1. Background

In Part 1, a series of scenarios for the near term future were defined. They range from full closure of all private salmon facilities to the operation of the four facilities at their "permitted" level. As economics are an issue, it is inevitable in an assessment of this type that a comparison of these scenarios on a economic basis should be attempted and that is what is being done here.

The obvious limitations of such an attempt should be apparent and for that reason, we do not expect to satify any particular view-point. However, we will, insofar as we can, consider all of the elements and, for each, be as close as we can to a reasonable middle ground.

To make such a comparison it is necessary to develop a range of numerical criteria. That delopment follows. The basis for selecting these specific criteria is probably no better than the data displayed elsewhere in this report which is, in some cases, suspect to poor. However, we have tried to make this as reasonable as possible by considering this information with judgement based on other work and by being relatively conservative.

In the development of this work we have made use of mathematical trending methods that are fairly crude but we think it better to define a trend inexactly than than to ignore it altogether.

Ranges are presented for some of these criteria for use in other parts of this assessment. These are described as being values used in the "Dynamic Model". However, in this economic comparison we will, for the most part, use mid-point values.

These criteria, if accepted as reasonable, will be very important to some as they attempt to decide which direction they want to go in support of private ocean ranching. Others will have little interest as their primary concerns are not related to quantification. Still others will be willing to accept the criteria but will reject the results on the grounds that the application is simplistic. We make no judgement as to who is right and we have sympathy for all positions. For those, however, who reject these criteria as being unreasonable or even incorrect, we can only ask that they provide better.

2. Economic Comparison Criteria

Survival (Harvest, catch and escapement combined) - Figures 19 provides information on coho survival rates for two sets of data for coastal hatcheries (public and private). This indicates that survival, based on past results, of less than1.0% can be expected once in 10 operating years and more than 5.2% once in 10 operating years. Stated another way, the past average survival rate has been 2.7% and returns have fallen in the range of 1.0% to 5.2% 80% of the operating years.

Figure 19 also indicates the trend of returns over 10 years for the same two sets of coastal hatcheries. The public hatcheries return trend would appear to be level at about 2.1% while the private hatcheries are trending up about 0.4% per year with 1987's trend "point" being 4%.

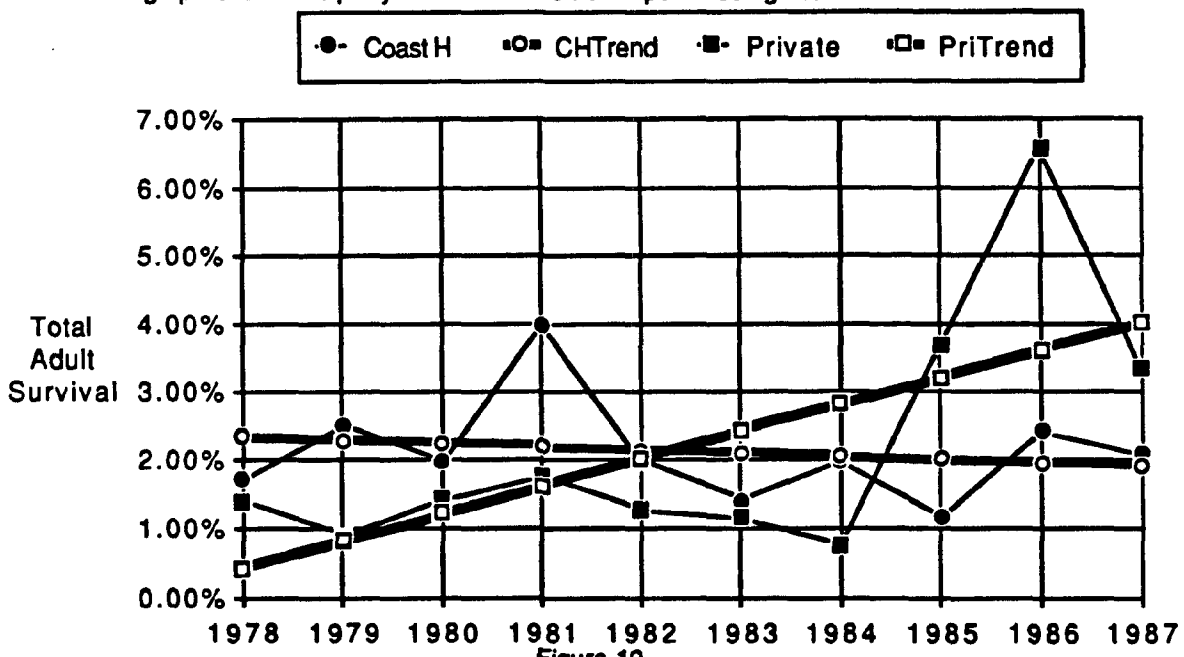

Figure 19
Survival Rates for Coho Salmon (excluding fish harvested outside of OPI Waters) from Private Hatcheries (Priv.CH) and Public Coastal Hatcheries (Pub.CH) showing data points and trend lines.

This tends to support the perception that the private facilities are improving in their performance while public coastal hatcheries have performed at a fairly constant level. (Note: the differences in survivals may be explained by the release conditions inherent in each of the systems and how and where smolt losses are accounted for. This is not necessarily an expression of relative performance.)

Figure 20 is a comparison of chinook and coho survival in the 1979-87 time frame. The trend line there would suggest that in that period the chinook survival rates are about 56% of the survival rates of

coho. Recent results have tended to a higher value, reflecting improvements of chinook release methods.

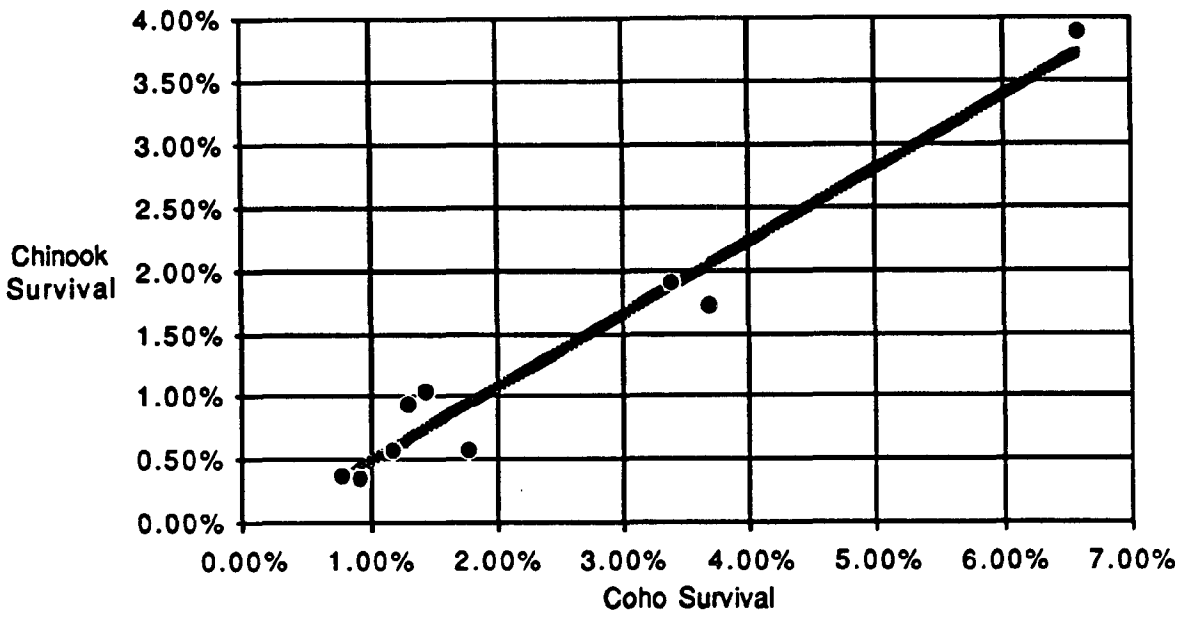

Figure 20
Survival Rates for Coho and Chinook Salmon (excluding fish harvested outside of the Oregon Coastal Waters) for Private Hatcheries showing data points and trend line.

For purposes of these criteria we will assume a total coho return averaging 4% reflecting both recent experience and the general trend. Chinook returns will be assumed to be 65% of the coho returns.

(Note: This data for private hatchery survival is based generally on past combined performance of three or four facilities operating in a learning mode. It would not be appropriate to estimate the future performance of individual facilities on the basis of this information as that will vary significantly from an average.)

"Catch" Split - Figure 21 indicates the relationship between sports and troll harvest of coho in Oregon as compared to the total OPI harvest of Coho for individual years in the 1971 to 1987 time period. (This data is developed on Table 3.) It is apparent that these trends reflect management strategies and natural conditions which tend to mitigate towards a higher percentage of sports harvest in years when the total harvest is low.and a higher proportion of commercial harvests when the total run is high.

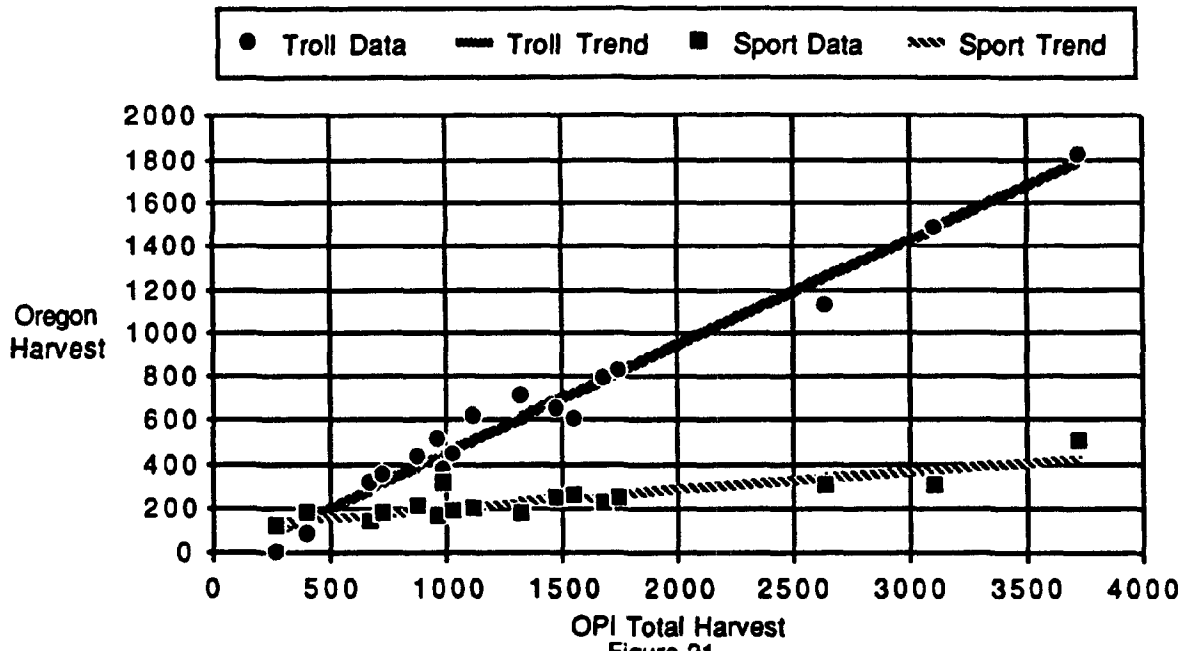

Figure 21
Oregon Coho Sport and Troll Harvest versus Total OPI Harvest for the Years 1971-87 in the OPI Area (in 1000's of Fish) showing data points and trend line.

Figure 22 develops the Sport/Troll harvest relationship again indicating a higher level of sports harvest when the total run is smaller.

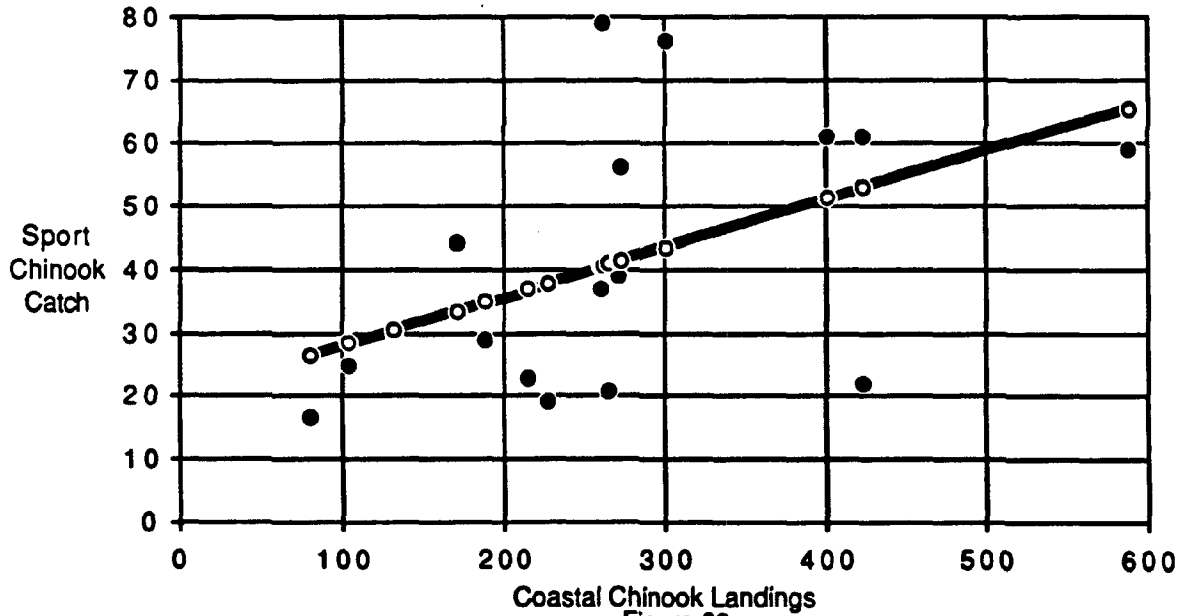

Figure 22
Chinook Sport Harvest versus Chinook Total Harvest for the Years 1970-87 in the Oregon Coastal Fishery (in 1000's of Fish) showing data points and trend line
(Data:Table I-4, 1987 PFMC "Ocean Salmon Fisheries")

We will use the relationships defined by the past (Figures 21 & 22) for projections for the future. These are:

Coho Oregon Sport Harvest =120,000 + 8.2% x Total OPI Coho Harvest
Coho Oregon Troll Harvest =(-)35,000 + 48.9% x Total OPI Coho Harvest
Chinook Sports Harvest =20,300 + 7.7% x Total Chinook Harvest

Recreational Angling Effort - The angler days expended on the sports fishery would appear (1970-1987) to be a function of total sports harvest in that more angler days are spent per fish when fishing is bad than when it is good (Figure 23). The relationship based on a trend line is that at a low harvest (200,000 chinook) the angler days is 242,000 or 1.21 days per fish while at a high harvest (1,000,000) it is 480,000 angler days or 0.48 days per fish.

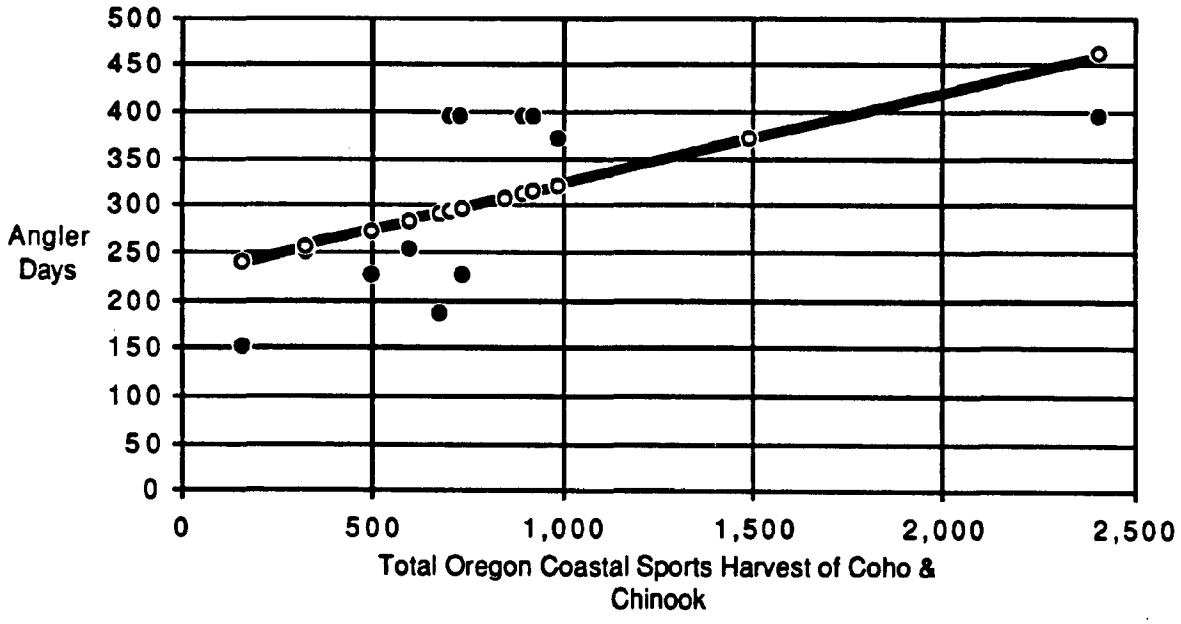

Figure 23
Recreational Angler Days versus Total (Coho and Chinook) Harvest for the Years 1970-87 in the Oregon Coastal Fishery (in 1000's of Fish) showing data points and trend line
(Angler Days Data:Table I-8, 1987 PFMC "Ocean Salmon Fisheries")
(Chinook Coastal Harvest Data:Table I-4, 1987 PFMC "Ocean Salmon Fisheries")
(OPI Coho Data: Coho Balance Master Table, Appendix)

We will use the relationship defined by the past (Figure 23) for projections for the future. This is:
Oregon Angler Days = 225,000 + 9.8% x Combined Oregon Sports Harvest

"Public/Private" Split of Private fish. - The "split" of private fish over the last few has varied from 78% private in one year for coho to as little as 34% for chinook. These variations probably reflect, to some degree, management decisions not specific to private salmon ranching but for the most part the represent natural conditions. Discussions with ODFW management personnel indicate that a higher level of consistency (+/- 10%) around some target point is possible.

For purposes of this effort we will assume that 55% of the "private" fish will be harvested as they return to the private hacheries. The rest will be harvested by sport and commercial fishermen.

Contributions by Other Sources - In the years 1985-87, the total OPI coho catch averaged 662,000 of which 109,000 (16%) were from the private salmon ranches and 105,000 from natural spawners. The "Other" contribution (i.e. from coastal public and Columbia River hatcheries was

448,000. In those same years the escapement to coastal rivers averaged 156,000 coho. (See Coho Balance Master Table). Thus the ratio between harvest and escapement was 1.00 to 149.

For purposes of this analysis we will assume that in our base year the natural OPI coho contribution will remain at 105,000 fish per year less any fish lost due to the impact of straying. (See below) The "Other" Coho Contribution will be assumed to be 448,000 fish.

In the years 1985-87, the total Oregon chinook coastal catch averaged 428,000 of which 25,000 (6%) were from the private salmon ranches. The remainder, 403,000, were from hatcheries and natural spawners. Estimates indicate that the coastal streams of Oregon had a total spawning escapement of 133,110 chinook in the year 1985. (NOAA Tech Memo NMFS F/NWC-12, by Wahle and Pearson, September 1987) which compares to a coastal goal of 150,000 to 200,000 (page II-23 1987 PFMC "Ocean Salmon Fisheries") For lack of better information we will assume that the ratio between harvest and escapement was 1.0 to 1.0 thus the natural contribution to the harvest133,000 (leaving 270,000 from"Other" sources)

For purposes of this analysis we will assume that in our base year the natural Oregon Chinook contribution will be at 135,000,000 fish per year less any fish lost due to the impact of straying. (See below) The "Other" chinook contribution will be assumed to be 270,000 fish.

Straying - In-system straying will be assumed to be 4% of the fish that return to the private hatchery and Straying outside of the system will be assumed to be 1.0%. These will not be counted either as returns or escapements.

Impact of Straying on Natural Production - In order that we might consider the negitive impacts of private ocean ranching it is necessary to consider the impact of straying on natural production. The information necessary to do this in a rigorous way simply is not available. The best we can do is provide a range of impacts for others to consider. This range will be defined in this way:

> **The Minimum Impact** is considered to be none.
>
> **The Maximum Impact** is considered to be as follows. Each "In-System" fish that strays will be assumed to reduce the effective number of natural spawners by 3/4th's of a fish up to the values indicated for adult escapement guidelines on Table II.G-1 of the 1982 ODFW "Coho Plan" or as indicated for chinook in NOAA Tech Memo NMFS F/NWC-12, by Wahle and Pearson, September 1987. Each "Out-System" fish that strays will be assumed to reduce the effective number of natural spawners by 1/2 of a fish.
>
> Each "Natural" coho lost as indicated above will result in the loss of one coho from the OPI survival. Each "Natural" chinook lost as indicated above will result in the loss of one chinook from the Oregon coastal survival.

Size at Return & Jacks - In most of these statistics coho jacks (define as under 20") are not counted either for numbers or weight. We will continue this in modeling and use and average harvest weight at the hatchery of 5.5 pounds which reflects actual experience. However, chinook jacks are counted in the returns numbers as are all of the year classes. In most of these statistics chinook jacks are define as fish under 24". We will continue this in modeling and use an average harvest weight at the hatchery of 10.1 pounds which reflects long term experience.

Since fish harvested at sea would be expected to be smaller than returning fish we will use slightly lesser values for "caught" fish, 5.0 pounds for coho and 9.0 pounds for chinook.

Economic Value of the Fishery - Recent studies by Radke, et al suggest the economic value of fish caught in the recreational fishery is in the range of $46 and $61 per angler day (Private boat vs Charter boat) in 1985 dollars. For this purpose we will use $52 per angler day ($1985)and not differentiate between boats.

The economic value of commercially caught coho (same source) will be assumed to be $3.46/pound with $2.84 being value to the coastal area and the rest being to other areas of the state. For chinook we will use $5.77 and $4.37.

The economic value of private hatchery coho (same source) will be assumed to be $1.71 for coho with $1.00 being value to the coastal area and the rest being to other areas of the state. For chinook (and considering 20% #2 quality fish) we will use $2.66 and $1.56.

No effort is made here to estimate the value of private fish held for egg production but the impact is certainly higher than for fish sold on the market.

It is our understanding that these economic values are reflective of community benefits and do not represent market prices for the fish.

3. The Economic Comparison of Scenarios

Based on the above criteria , an economic comparison of scenarios was developed in detail (See Economic Comparison Table in the Appendix) The comparison of scenarios is shown on Figure 24 for the "Maximum" Straying Impact Assumptions. What is illustrated here is that the economic impact of fishing for the "Maximum" Scenario is over $80 million as compared to the impact of fishing for the "Closure" scenario of $35 million. Thus the increase attributed to "private" fish is over $46 million.

An aspect of the economic comparison is the impact of straying on total harvest levels. Based on the criteria set above, the economic economic impact of fishing assuming the "Maximum Development Scenario" is $81.6 million assuming "Maximum Straying Impact" and $82.4 million assuming "No Straying Impact". Thus the impact of straying is less than a million dollars as compared to the impact increase attributed to "private" fish of over $46 million. Thus the economic."Gain/Loss" ratio is about 50:1.

Another basis for comparing scenarios is in terms of the total number of fish harvested (coho and chinook). This is done on Figure 25 where the average values for Oregon's sports and troll harvest are indicated for various scenarios. Also indicated is a value which represents the maximum stray loss from the system based on the "maximum" criteria (Note: These values represent the Oregon harvest for both fish. The OPI values for coho are indicated on the backup table "Economic Contribution Table" in the Appendix.) The gain under the "Maximum" Scenario is is about 740,000 fish and the straying loss is approximately 37,000 fish. Thus the "Gain/Loss" ratio for fish is about 20:1.

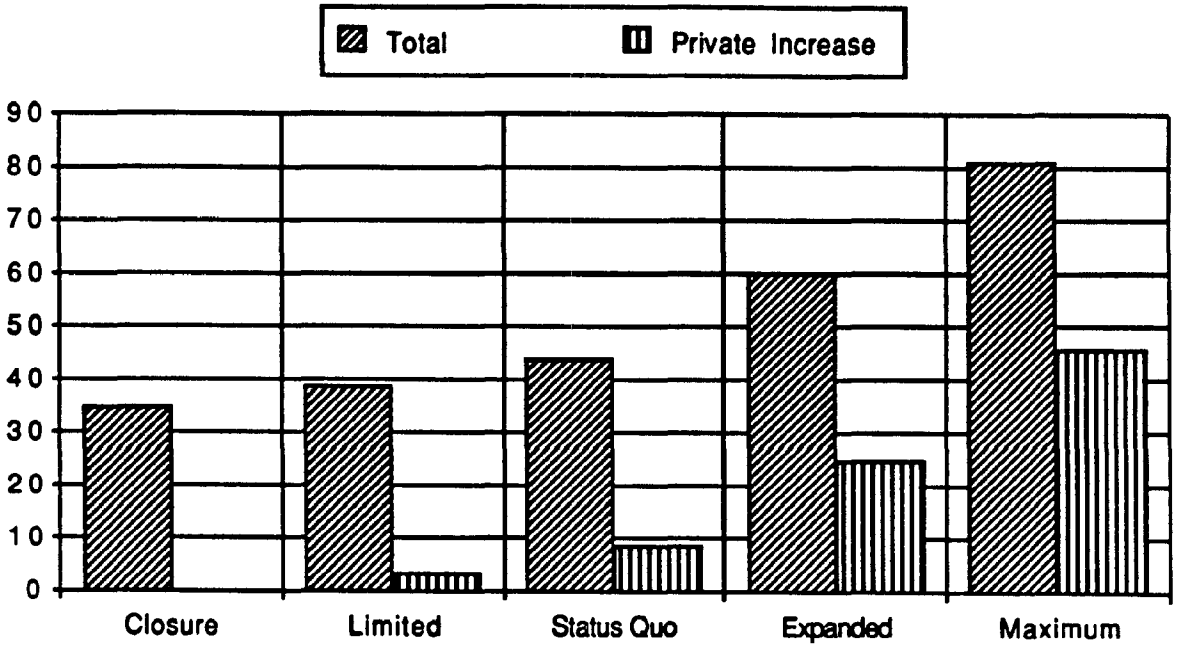

Figure 24
The Base Year Annual Economic Impact on the State of Oregon of Various Scenarios for the Development of Private Salmon Ranching based on Maximum Straying Impact Assumptions.

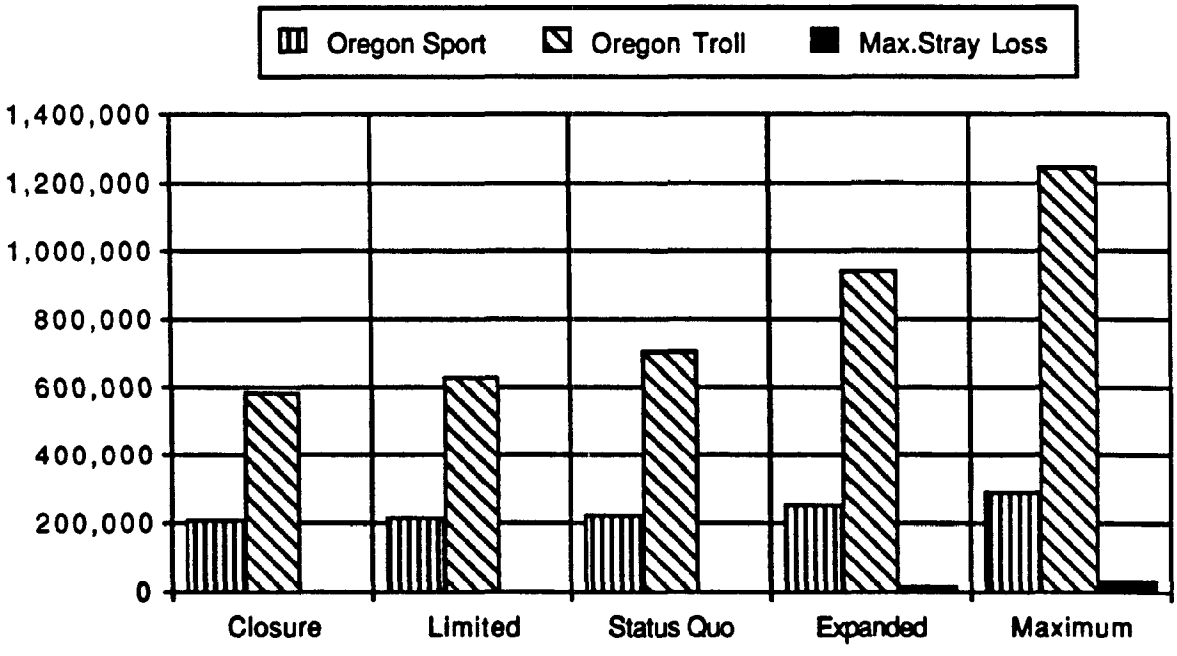

Figure 25
Annual Projected Harvest in the State of Oregon for Various Scenarios for the Development of Private Salmon Ranching. The Maximum Stray Loss Indicated is Based on Assumptions Defined in the Text

Q. Variations In Private Production

Background - A point of discussion for those involved in the impacts of private salmon ranching is in the desirability of stability in production levels and programs. A review of production and return data of Part 1 would clearly indicates that the release from the private facilities have varies greatly both by species and in numbers. It has been suggested that permits should be defined in terms of species, stocks and maximum and minimum numbers. Ideally, in some views, production would be as constant as found in state facilities where the annual production plan is based more on long term consensus than on short term returns.

The private rancher, on the other hand, is working towards survival and his primary incentive is reaction to annual returns. Complicating this is the relative, and increasing, attractiveness of egg and smolt sales that depend on salmon ranching activities but do not necessarily benefit by maximum releases. The many, and complicated, possible strategies do not always result in stability in production levels and in programs.

Finally, the state's ambivalence to the private rancher's role in the state's basic production program does not lend itself to encouraging production stability. There is no incentive, except economic returns, for the private ranchers to seek stability. In these last few years, this incentive has been extremely variable.

Significance - Ideally, the private ranchers could improve support by stability in their production programs. Realistically, this stability will only result if it is economically attractive.

Proposed Consensus Response to this Issue - **To ask private ranchers to make their production programs significantly more stable than those defined by their permits will require that their economic benefit be a positive one or that there be some other operating trade-off.**

Acceptance - This proposed consensus is generally accepted.

R. ODFW's Policy on the Support of Private Salmon Ranching

Background - In every way ODFW is part of private salmon ranching. They approve or deny the permits, they take part in the decisions on stocks to be planted, they approve planting programs and check for tags. They manage a common fishery and do have a significant impact on how many fish return to the harvest weirs. They can, without regulation change, increase or reduce the profitability of some or all of the active operations. They include "private" fish in their harvest projections and in their catch statistics.

Similarly, but with less control, private salmon ranching is a part of ODFW. They spend money to plant fish that they will never own and to the benefit of fishermen and businesses. If they make mistakes (knowingly or not) their operations can harm natural production and reduce the net benefits.

For all of this there is no clearly defined ODFW policy as to what role it would like private salmon ranching to take in providing fish nor is their any statement as to ODFW's policy in support of private salmon ranching.

Significance - This has significance in several ways:

1. In planning future fish propagation for the state, the level of private contribution to the coho catch could vary from nothing, if they all closed, to almost 1.5 million fish for the best possible year for the existing permits (60% of 7.5% of 32.8 million smolts) . With this in mind, how does ODFW develop their own plans?

2. Ideally the setting of regulations and/or in their administration, decisions grow out of policy. If the basic policy were very supportive of ocean ranching one would expect that decisions on any particular issue would be consistent regardless of when they are made or who makes them. (Whether or not that

decision favors salmon ranching is another questions since no policy of support could ignore other imperatives.) Without a basic policy, decisions are more subject to misunderstandings, individual biases, and perceived community pressures.

> An example of this was in a recent attempt to define an appropriate prepayment level for private ranchers who want to buy spring chinook eggs from the state. In the past, eggs were ordered. ODFW captured and held the fish at some expense and trouble. Then the order was cancelled and no payment made. The department, concerned with what seemed to be bad faith, defined two responses for consideration in revising their regulations: (1) require a 100% deposit; or (2) require a smaller deposit and a contract that would guarantee later payment.
>
> The 100% deposit is a burden on the private growers but very protective of ODFW. The deposit and contract protects the state and is less burdensome to the grower but it does increase chances for lawsuits, not good for the state.
>
> Were the Department's policy to encourage, insofar as consistent with other ODFW responsibilities, private salmon ranching, the choice of regulation would lean to the smallest possible deposit. A neutral or negative policy would lean towards a 100% deposit.
>
> This decision is soon to be made and the results will indicate a policy position (pro or con) that may or may not reflect the message the Department wants to send.

3. In seeking financial support, private salmon ranchers have little to point to that demonstrates the state's interest in supporting operations. While history is helpful in demonstrating some degree of stability, it also provides a basis for some to see a pattern of shifting policies and apparent individual and state obstruction.

> A recent example perceived to illustrate this is found in an action taken by the ODFW Commission on October 14, 1988. On that date the Commission met to consider a "basin plan" proposed for the Coos River Basin. Among other things, this plan proposed that the management of salmon in the basin be focused on hatchery fish, called plan "C". (This was in contrast to management plans that would place a much greater emphasis on protecting naturally spawning salmon in the basin, called Plan "B".) The proposal (including Plan "C") was developed over 18 months by a planning committee designated by ODFW and their findings were supported by ODFW staff.
>
> At the October 14th meeting, the proposal (including "C") was introduced and supported by the planning committee, the ODFW staff and the major private salmon rancher in Coos Bay, Anadromous. Anadromous expressed special concern during the planning process for Plan "C" declaring that without it they would abandon their spring chinook program and quite possibly their entire operation.
>
> At the October 14th hearing a group that opposed Plan "C" spoke and the ODFW Commission accepted their view and amended the proposal to change Plan"C" to Plan "B". This failure to follow staff and/or advisory committee recommendations on such an issue was generally viewed as being unusual. The following events grew out of (or were generally perceived to grow out of) that decision:
>
> - The Advisory Committee members were typically displeased that their decision growing out of a very public, 18 month effort was overruled on this issue.
>
> - Anadromous made the corporate decision to stop spring chinook production.
>
> - A stock offering of approximately $5 million intended to allow Oregon Salmon, Inc. to purchase and continue operations of the Ore-Aqua facilities was withdrawn by the underwriters. The justification is contained in a statement from the underwriters which said in reference to the Coos Basin decision:

"Recent decisions by the State Fish and Wildlife Commission have brought into focus the arbitrary nature of decisions which fundamentally alter future prospects for salmon ranching. We feel constrained to have public investors at risk in this business until the governor's office, the state legislature and the Fish and Wildlife Commission develop a long term framework which would allow salmon ranchers to grow their businesses."

- A representative of Ore Aqua said, "This is a major setback for both of us (Ore Aqua and Oregon Salmon, Inc.)" but indicated that they will continue to operate while moving forwards with sales efforts.

- A representative of Oregon Salmon, Inc. said, "We hope the state will recognize the importance of ocean ranching to the economy... At this point the support is not as strong as we think it should be." He also indicated that his firm will seek other financing means if necessary.

- ODFW released a statement which quoted a spokesman, " Our action reflected our concern that salmon management in the basin strike a reasonable balance between hatchery and natural production. It was not our intent to unfairly inhibit private operations nor do I believe it will have that effect" The same statement started "Commission Supports Private Salmon Hatcheries - The Oregon Fish and Wildlife Commission believes privately-owned salmon hatcheries plan an important role in production salmon for public as well as private use..."

- Three coastal legislators announced that they would "attempt to revive a measure that would allow the state to take over Oregon Aqua Foods and other private state hatcheries." This referred to the 1987 legislation that was vetoed by the governor.

<u>What we have here is a failure to communicate.</u>

As this is written, and perhaps in reaction to the displeasure voiced in a number of sectors, the Commission and ODFW staff is working on finding a resolution that might be viewed as being more supportive of private salmon ranching.

4. Within the ODFW staff there is a wide variety of individual views as to whether private ocean ranching is good or bad or something else. These views not withstanding, each believes that what they do reflect the de facto policy of the Department. However without clear direction, they will follow their own bias and as they do they are often uncomfortable. Many of the ODFW staff with responsibility in this area have indicated to us a need for a clear policy. Those who felt that there was no pressing need felt that way because they saw within the detail of regulation, a policy statement.

There is a question if ODFW has the authority to express a policy without it being first defined by the legislature. At a minimum they should be able to define policy within the framework of their propagation responsibilities. Alternatively they can ask the legislature for guidance.

Proposed Consensus Response to this Issue - **A clearly stated, and effectively communicated, ODFW policy defining its level of support for of the concept of private salmon ranching would improve the Department's consistency in dealing with issues and developing regulations. A clearly stated, and effectively communicated, ODFW policy <u>in support</u> of the concept would improve private salmon ranching's ability to develop financial support.**

Acceptance - This proposed consensus is almost universally accepted.

S. The Cost of Replacing Production Capacity

Background - A point of interest to some has been the cost to replace the production capacity now in place in the private facilities. This is of interest to those who suggest that ocean ranching is appropriately a state function function and that the state should be producing these fish.

The first question is "what capacity are we talking about?". For the sake of this discussion we will consider the same production scenarios that we considered in the earlier economic comparisons. (i.e., from "Closure" to "Maximum".) However, when we speak of production it will be releases that acheive the same public harvest levels rather than the same release levels.

We will assume that the returns to the release sites will be managed to produce a return equal to 20% of the total survival rather than 55%. (This would,of course, require harvest management changes that could have a negitive impact on naturally spawning fish but at this time we will ignore this concern.)

The next question is how much it would cost to replace this capacity? This can be considered in three ways:

1. **Purchase fish.** In a recent study for the state of California, it was estimates that the State could buy salmon for $3.04/pound if they were available. ("California Hatchery Evaluation Study", The Mayo Associates, April, 1988) We will assume $3.00/pound and 45 gram smolts. (This production cost estimate has been generally validated by several private operators in Oregon. Exact values are not available.)

2. **Buy the existing facilities** and then operating them. (This was the subject of legislation that was passed in 1987 and then vetoed.) We assume that the total.effective cost is similar to purchasing fish directly. Specific estimates of the initial capital costs are difficult to define since to do so will require more knowledge of the existing private facilitiy capabiilities than is now available.

3. **Build new facilities** and then operating them. Here we have the advantage of earlier studies of hatchery capital and operating.costs. ("Washington Salmon Plan", Kramer, Chin and Mayo, Inc., 1976). Based on that study, updated to current price levels, the cost per pound of rearing capacity for a large salmon hatchery of average complexity, is $25 to $40 ($2.50 to $4.00/smolt). The operating cost is on the order of $1.80/pound.

We will use the "purchase fish" options in this analysis and assume a $0.30/smolt cost in terms of annual public investment. We believe this is approximately the same as the cost of the "Buy Existing Facility" option and less than the "Build New Facility" option. (See "Economic Contrib. Table II in the Appendix for the detailed calculation.)

Significance - The primary significance of this issue relates is in the public investment required to produce equal to the various private ocean ranching scenearios. This is illustrated on Figure 26 where it is indicated that the public investment required to equal the "Status Quo" Scenario is just over $2 million per year with the investment equivalent to the "Expanded" and "Maximum" scenarios is $6.2 and $11.4 million respectively.

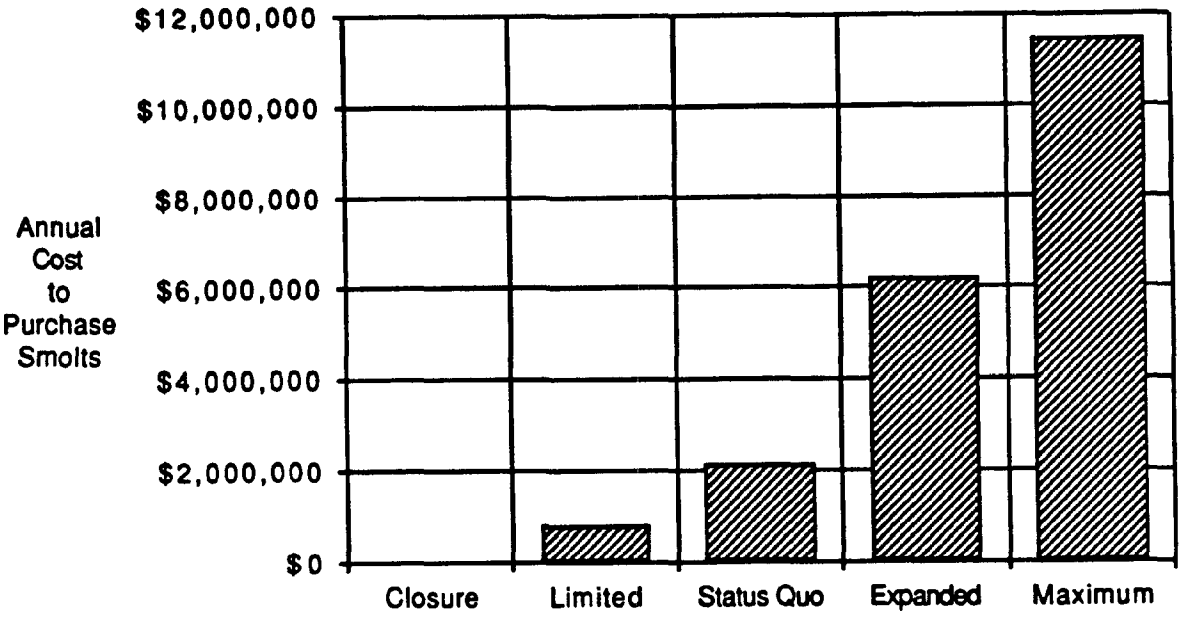

Figure 26
Annual Public Investment Required for the Purchase and Release of Smolts to Produce Harvest Levels Equivalent to the Private Ocean Ranching Scenarios Indicated.

Proposed Consensus on this Issue - **Assuming the assumption made are valid, the public investment that would be required to replace the contribution of the private ocean ranchers is currently on the order of $2 million per year. The investment that would be required to reach harvests equivalent to any of the expanded scenarios is in excess of $6 million.**

Acceptance - This proposed consensus is accepted as reserved above.

Table 3-OPI/Oregon Harvest

	Coho Troll Ocean Catch Inside OPI Area	Coho Sport Ocean Catch Inside OPI Area	Coho Total Ocean Catch Inside OPI Area	Coho Troll Ocean Catch Oregon Coastal Area	Coho Sport Ocean Catch Oregon Coastal Area	Coho Total Ocean Catch Oregon Coastal Area	Chinook Sport Ocean Catch Oregon Coastal Area	Total Sport Ocean Catch Oregon Coastal Area	Salmon Recre. Angler Days
Year	1000's Note 1	1000's Note 1	1000's Calc.	1000's Note 2	1000's Note 2	1000's Calc.	1000's Note 3	1000's Calc.	1000's Note 4
1971	2,422	682	3,104	1,490	312	1,802	30	1,832	
1972	1,215	534	1,749	825	248	1,073	44	1,117	
1973	1,257	422	1,680	796	232	1,028	61	1,089	
1974	1,995	637	2,632	1,137	314	1,451	37	1,488	372
1975	1,028	442	1,469	657	252	909	76	985	372
1976	2,796	931	3,727	1,827	501	2,328	79	2,407	396
1977	633	393	1,025	446	195	641	61	702	396
1978	1,052	500	1,551	612	260	872	23	895	396
1979	1,006	319	1,325	715	181	896	21	917	396
1980	483	501	984	383	326	709	19	728	396
1981	789	328	1,117	620	200	820	29	849	311
1982	691	272	964	522	175	697	39	736	226
1983	401	261	662	320	147	467	25	492	226
1984	85	176	260	14	123	137	17	154	153
1985	132	264	397	84	182	266	56	322	252
1986	578	296	873	440	212	652	22	674	186
1987	430	286	715	355	177	532	59	591	255
85-87	380	282	662	293	190	483	46	529	231
Note 1 - See Coho Balance Master Table									
Note 2 - Table I-5 1987 PFMC "Ocean Salmon Fisheries"									
Note 3 - Table A-10 1987 PFMC "Ocean Salmon Fisheries"									
Note 4 - Table I-4 1987 PFMC "Ocean Salmon Fisheries"									

Part 4 - The Choice of Scenarios

This part of the assessment is intended to consider the scenarios defined in Part 1 in terms of the factors which will influence the ultimate choice of scenario .These factors include:

Public Support
ODFW Policy
Nature's Impacts
Concern for Natural Production
Economic Agreements
Return on Investment
Economic Impact Comparison of Scenarios
Comparison of Public Harvest Levels
Equivalent Public Investment
Individual Initiative
Harvest Management

A. The Scenarios

These are the scenarios defined in Part 1 which represent our view of the range of possibilities for private salmon ranching in the year 2000.

1. **Closure** - Of all operations (OAF, Anadromous, Oregon Pacific, Domsea).

2. **Limited Operations** (based on meeting farming needs) - Chinook: Anadromous, 1.5 million; OAF, 1.5 million; Oregon Pacific, 0.8 million; Total, 3.8 million. Coho: Anadromous, 0.5 million; OAF, 0.5 million; Total, 1.0 million.

3. **Status Quo** - Chinook: Anadromous, 3.0 million; OAF, 4.0 million; Oregon Pacific, 1.0 million; Total, 8.0 million. Coho: Anadromous, 1.0 million; OAF, 4.0 million; Total, 5.0 million.

4. **Expanded Operations** - Chinook: Anadromous, 6.0 million; Domsea, 6.0 million; OAF, 6.0 million; Oregon Pacific, 2.0 million; Total, 20.0 million. Coho: Anadromous, 6.0 million; Domsea; 6.0 million; OAF, 6.0 million; Total, 18.0 million.

5. **Maximum Operations** (Assumes full permit operations at all sites) - Chinook: Anadromous, 9.4 million; Domsea, 12.0 million; OAF, 10.6 million; Oregon Pacific, 5.0 million; Total, 37.0 million. Coho: Anadromous, 11.3 million; Domsea; 12.0 million; OAF, 9.5 million; Total, 32.8. million.

B. Public Support for Private Salmon Ranching

1. The Questionnaire

Perhaps the most important of the factors noted above is public support for private ocean ranching. This in turn is based on their perception of it which in turn depends on how well the various scenarios match those social goals that the public thinks are important. As a basis for testing this match, we prepared the following questionnaire and sent it to the advisory committee for this study, a list of individuals that we had been asked (by OCZMA) to interview and a number of OCZMA board members. The overall response rate to the questionnaire was about 65%.

The Questionnaire was as follows:

"From: Ron Mayo
To the Advisory Committee, Carol Brown, Jay Rassmussen, Interview List, Genetics Experts, Private Salmon Ranchers, Legislators and all.

Enclosed is a partial draft of this study discussing the key issues in Private Salmon Ranching in Oregon. We are looking towards you for some type of response as indicated on the attached transmittal but we would appreciate it if you would answer a few specific questions about yourself and your general views. (We don't intend to use individual responses in connection with anyone's name but we would like to be able to understand you perspective and get a little help in deciding what's important to you.)
Name _____ - Phone (____)_____

Question #1. How would you characterize your role in Private Salmon Ranching? (Pick the one best description)

a. Part of the Ocean Ranching Industry _____.
b. Part of the Commercial Fishing Industry _____
c. Part of the Recreational Fishing Industry _____
d. A Sports Fisherman _____
e. A State (or Federal) Fishery Agency Representative _____
f. A State (or Federal) Non-Fishery Agency Representative _____
g. A University Employee _____
h. A Legislator or a Legislative Staff Person _____
i. A Local Government Representative _____
j. An Interested Business Person _____
k. An Interested Private Citizen _____
l. Other _____.

Question #2. How would you characterize your own views relative to ocean ranching? (Pick the response closest to you views.)

a. **Close all** -It is a very bad concept for all concerned and it should be stopped as quickly as possible.

b. **Significantly Reduced** - The risk are so great and the benefits are so small and to so few. Therefore, it is likely that ocean ranching will fail either for economic or scientific reasons and that any continuation should involve a significant tightening of the legislation as it now exist

c. **At or Below Present** - Under very careful control, ocean ranching at or below present levels should be allowed but only under with some tightening of the legislation as it now exist

d. **At or Above Present** - Under reasonable control, ocean ranching at or somewhat above present levels should be allowed within a balanced interpretation of the legislation as it now exist

e. **Well Above Present** - Under some basic control, ocean ranching at well above present levels should be allowed and encouraged within the most liberal interpretation of the legislation as it now exist

f. **Significant Growth** - The risk are so small and the benefits are so great for so many. Therefore, ocean ranching should be allowed significant growth with some liberalization of the legislation

g. **No Limits** - This is a very good concept and there should be no limits on ocean ranching

Question #3 We have defined (in Part 3 of the draft) a set of public goals as follows:

Natural Production - To protect the natural production of salmon in the coastal rivers - because this production costs little and because this activity supports other social goals including the preservation of these rivers in their natural state.

Genetic Integrity - To protect the genetic integrity of wild salmon populations from further compromise - because these fish may have special value in a number of ways especially in the future health of the salmon resource.

Maintain Benefits - To provide at least a continuation of past levels of fishing opportunity to sports and commercial fishermen - because this diversity of types of livelihood and recreation is socially desirable.

Expand Benefits - To expand the economic benefits of the coastal salmon resource - because there is a need to improve the economic base of the coastal communities and the State of Oregon.

Consumer Interest - To protect the interest of the consumer who buys these fish by fair prices and good quality - because the fishery resource should not be developed only to benefit the fishermen or the salmon or the rivers or the private salmon ranchers.

Oregon Control - To keep control of the fishery resource with the State of Oregon - because such control is the best device we now know to provide long term protection of the resource.

Taxpayer Cost - To minimize cost to the taxpayers - because this is what the taxpayer wants.

Privatization - To benefit from the special resources of private industry - because there are some things they do better than bureaucratic institutions.

Investment - To provide investment opportunities to the citizens - because ours is a free enterprise system.

Jobs - To provide jobs whose content is of interest to people in Oregon - because to some an interesting job is more important than a high paying job and to support this philosophy in some is socially desirable.

Please rate each of these 10 goals from not important = 0, somewhat important = 1, important = 2, or very important = 3."

2. The Response

The response to this questionnaire is as indicated in a series of figures:

Figure 27 indicates the mix of those making responses. We made no attempt to achieve any particular balance in the responses except as indicated in the description of the people to whom this questionnaire was sent. However, it would appear that most groups who have been interested in this question are represented in the responses.

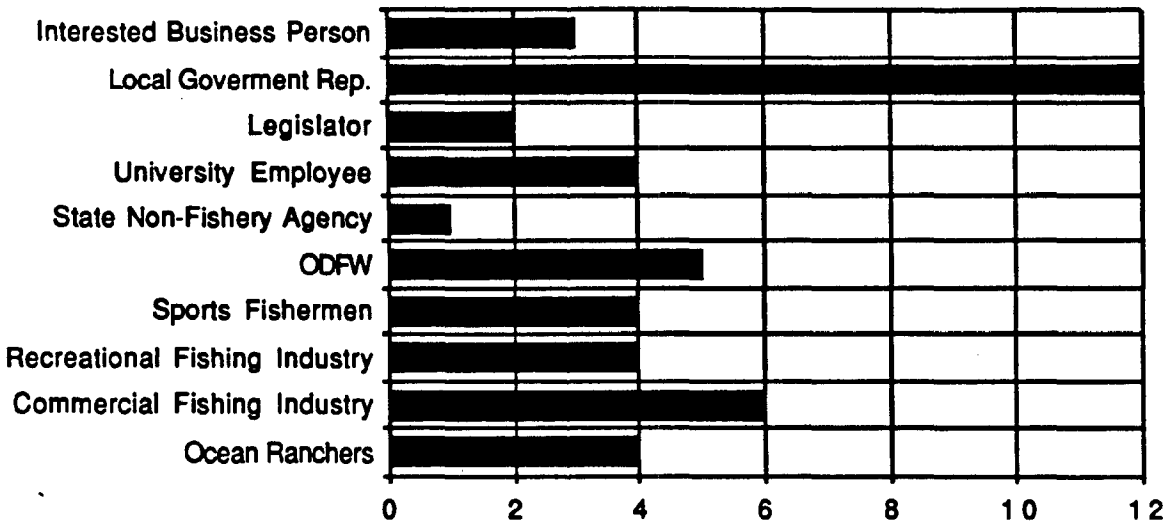

Figure 27
The Number of Individuals Responding to Questionnaire by Category
(Total of 45)

Figure 28 indicates the levels of support for Private Salmon Ranching as described in Question #2 above. These categories were not specifically defined as are the scenarios indicated above for several reasons. The most important reason was that the scenarios were focused on releases and public perceptions focus on results. However, we believe that the relationship between the two ranges is approximately as follows:

Scenarios	Question #2
Closure	**Close All**
Limited Operations (A little below Status Quo)	**Significantly Reduced**
Status Quo (A little above Status Quo)	**At or Below Present** (None)...
Expanded Operation	**At or Above Present** (None)...
Maximum Operation (Beyond Maximum Operation of Existing Facilities)	**Significant Growth** **No Limits**

Figure 29 describes levels of support for the various groups that responded. In general, support was a little more than "At or Above Present" (Approaching the "Expanded Operation" Scenario) with the Fishermen as a group being "At or Below" and the private ranchers being at a "Significant Increase".

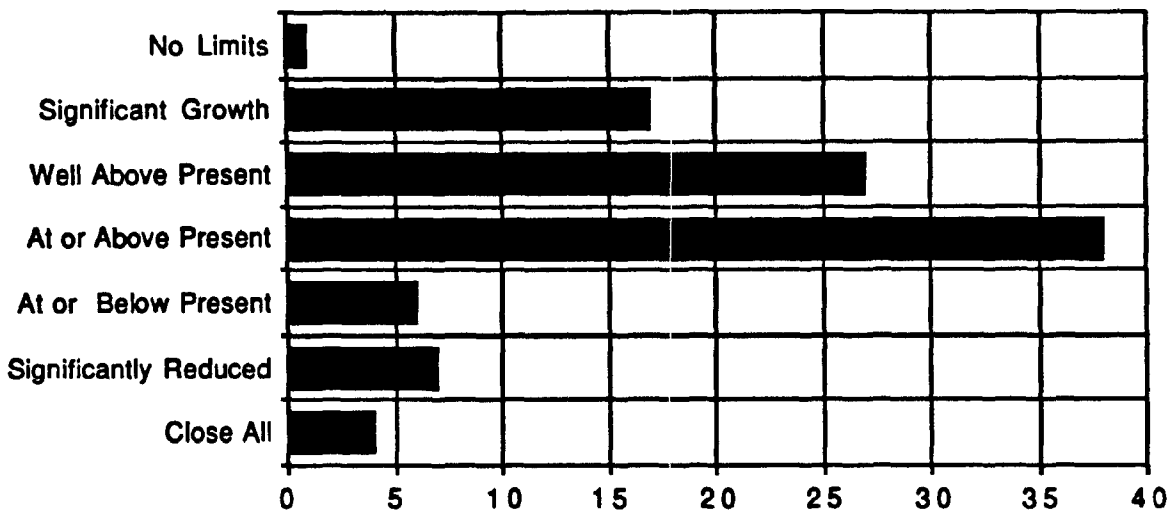

Figure 28
Percentage of Responses Indicating Various Levels of Support for Various Growth
For Private Ocean Ranching

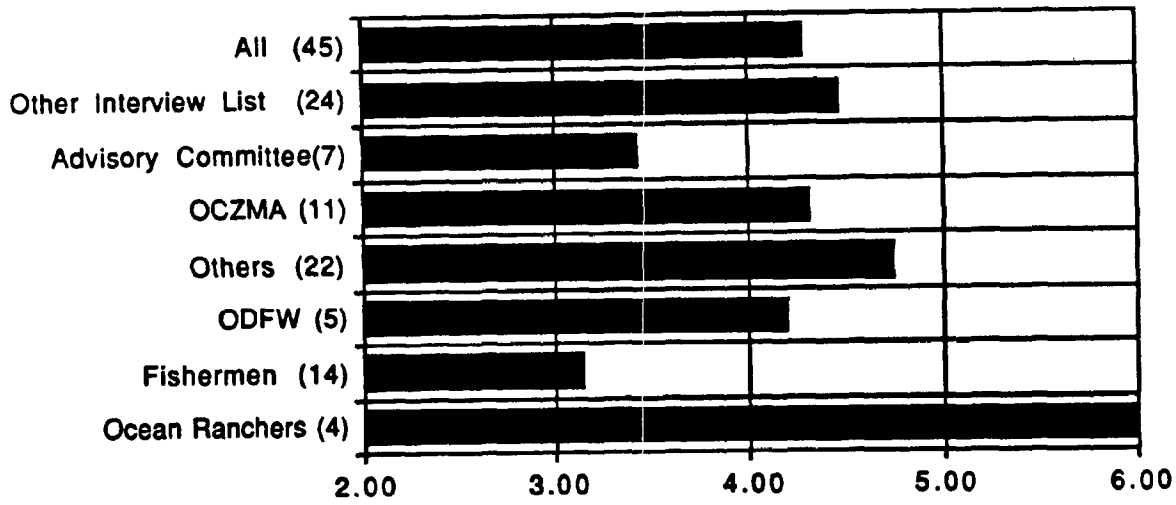

Figure 29
Support Level by Group for Private Ocean Ranching
(2=Significant Reduction, 3=At or Below Present Level, 4=At or Above Present Level,
5=Well Above Present, 6=Significant Increase)

Figure 30 relates to Question #3 on Public Goals. The intent of this is find out how people feel about those public goals which might be impacted by Private Ocean Ranching. The goals of expanding and maintaining the economic benefits received the highest response followed by protection of natural stocks and providing for genetic integrity. Of least interest was providing investment opportunities and jobs in private hatcheries.

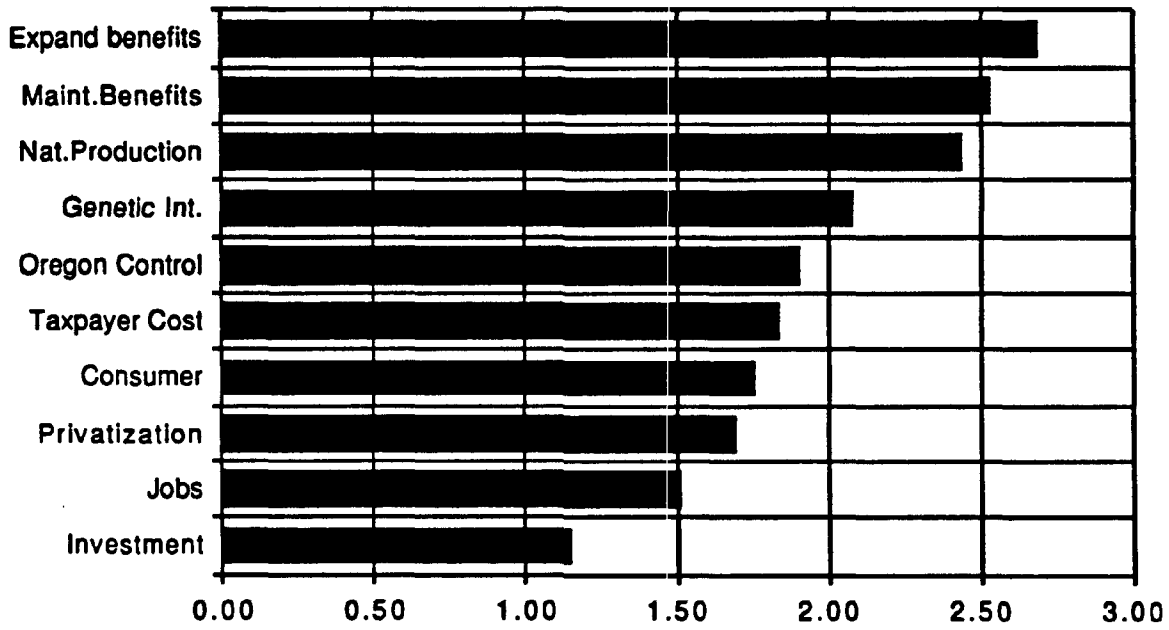

Figure 30
Relative Importance of Various Goals
(0=No Importance, 3=Very Important)
As Defined by Respondents to Questionnaire

3. A Comparison of Scenarios

The above responses provide a basis for comparing the scenarios described above. Such a comparison, however, is very much an individual activity. How it might be done by three different, and mostly imaginary individuals is illustrated on Table 4 and Figure 31.

On Table 4 we have three people comparing the scenarios. Person #1 would appear to be focused on hatcheries and private enterprise. Person #2's view seems more focused on fishing as an activity with a belief in natural production as a primary source for fish. To each person we have ascribed certain views as to the relative impact of each scenario on the list of goals and to each goal we have ascribed a weight. (By the way, the weights are actual responses from two individuals. They are compared to the weights defined by the entire group.) For each person we calculated weighted totals of points by multiplying goal values times assigned points (with 50 points assigned to each goal)..

A third person's view (a "Strawman") is developed that uses the weights defined by the entire group and the average points defined for Persons #1 & #2.

All three of the above point totals are illustrated on Figure 31.

It is clear that within this development of comparisons to illustrate what would appear to be a range of public perceptions, we have opened a new area of disagreement. That is, What is the public view? In fact, there is no one view but many and, at best, we can only illustrate a few. However, we feel that,

while a person may be interested in other's views the most important view is their own. For those who want to compare their views with our examples we are providing Table 5 - "The Reader's Ranking" and suggest that each may wish to go through the exercise for themselves.

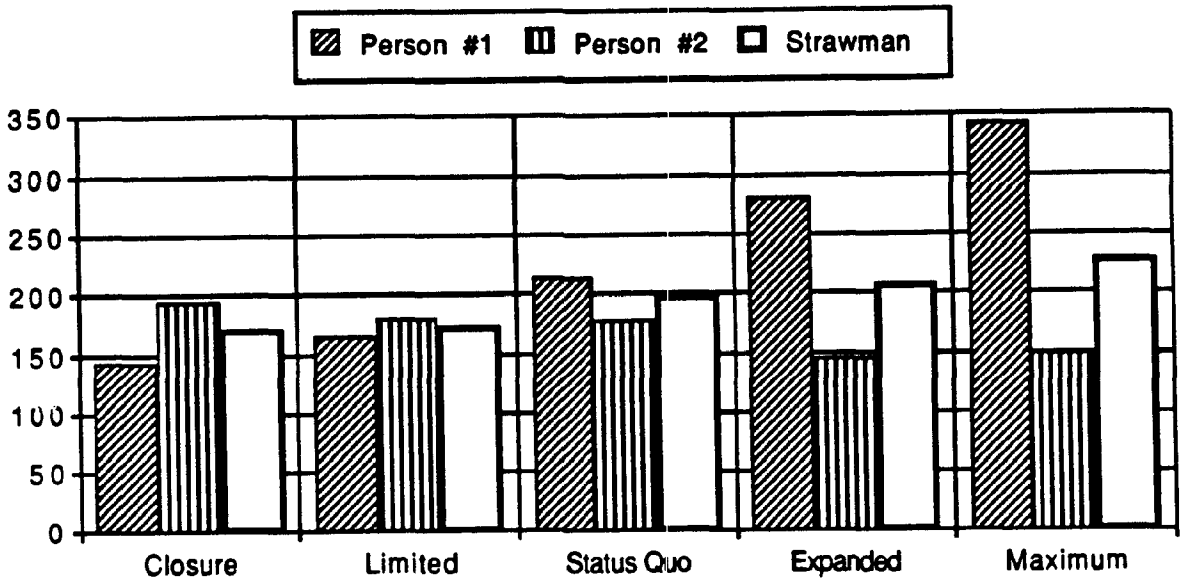

Figure 31
The Weighted Rankings of Various Scenarios as Defined by Imaginary Individuals of Various Perceptions.
This is based on the choices made on Table 4.
(Higher point totals favor scenario)

4. Summary on Public Support

What we have learned from this is:

a. It would appear (through Question #2) that there is general support for some expansion of Private Salmon Ranching and that views are related to each individuals role. Few are willing to take extreme positions.

b. That there is a diversity in views as to what goals may be best served by private salmon ranching but that economic benefits to the community rank above the rest.

c. That quantification of goals as related to scenarios can provide insights and could be viewed as supporting the conclusion suggested in (a) above, that there is support for ocean ranching and for some expansion.

d. That each individual may wish to quantify their own views.

While we do not pretend that this analysis of public support is definitive, we have found it interesting that one one has suggested that the conclusion is flawed.

Table 4 - Scenario Ranking

Person #1	General Voted Catagory Weight	This Person's Catagory Weight	Points Closure	Points Limited	Points Status Quo	Points Expanded	Points Maximum
Investment	1.15	3.00	5	5	8	15	17
Jobs	1.52	2.00	5	7	10	14	14
Privatization	1.70	3.00	2	5	8	14	21
Consumer	1.76	3.00	6	7	10	12	15
Taxpayer Cost	1.84	3.00	8	8	10	12	12
Oregon Control	1.91	2.00	15	12	10	8	5
Genetic Int.	2.08	1.00	20	15	10	3	2
Nat.Production	2.44	1.00	13	12	10	8	7
Maint.Benefits	2.53	2.00	4	7	13	13	13
Expand benefits	2.69	3.00	0	4	7	14	25
Weighted Points			144	166	215	282	343
Person #2			Closure	Limited	Status Quo	Expanded	Maximum
Investment	1.15	0.00	7	6	9	14	14
Jobs	1.52	0.00	7	8	11	13	11
Privatization	1.70	1.00	4	6	9	13	18
Consumer	1.76	1.00	8	8	11	11	12
Taxpayer Cost	1.84	1.00	10	9	11	11	9
Oregon Control	1.91	3.00	17	13	11	7	2
Genetic Int.	2.08	3.00	21	16	11	2	0
Nat.Production	2.44	3.00	14	13	10	7	6
Maint.Benefits	2.53	2.00	6	8	14	12	10
Expand benefits	2.69	3.00	2	5	8	13	22
Weighted Points			196	180	179	146	149
Strawman			Closure	Limited	Status Quo	Expanded	Maximum
Investment	1.15	1.15	6.0	5.5	8.5	14.5	15.5
Jobs	1.52	1.52	6.0	7.5	10.5	13.5	12.5
Privatization	1.70	1.70	3.0	5.5	8.5	13.5	19.5
Consumer	1.76	1.76	7.0	7.5	10.5	11.5	13.5
Taxpayer Cost	1.84	1.84	9.0	8.5	10.5	11.5	10.5
Oregon Control	1.91	1.91	16.0	12.5	10.5	7.5	3.5
Genetic Int.	2.08	2.08	20.5	15.5	10.5	2.5	1.0
Nat.Production	2.44	2.44	13.5	12.5	10.0	7.5	6.5
Maint.Benefits	2.53	2.53	5.0	7.5	13.5	12.5	11.5
Expand benefits	2.69	2.69	1.0	4.5	7.5	13.5	23.5
Weighted Points			171	174	199	207	230

Table 5-The Reader's Ranking

A	B	C	D	E	F	G	H	I	J	K	L	M
Reader #1	General	The	The		The		The		The		The	
	Voted	Readers	Readers		Readers		Readers		Readers		Readers	
	Catagory	Catagory	Points*	Columns	Points*	Columns	Points*	Columns	Points*	Columns	Points*	Columns
	Weight	Weight	Closure	C x D	Limited	C x F	Status Quo	C x H	Expanded	C x J	Maximum	C x L
Investment	1.15											
Jobs	1.52											
Privatization	1.70											
Consumer	1.76											
Taxpayer Cost	1.84											
Oregon Control	1.91											
Genetic Int.	2.08											
Nat.Production	2.44											
Maint.Benefits	2.53											
Expand benefits	2.69											
Weighted Points												
Reader #2	General	The	The		The		The		The		The	
	Voted	Readers	Readers		Readers		Readers		Readers		Readers	
	Catagory	Catagory	Points*	Columns	Points*	Columns	Points*	Columns	Points*	Columns	Points*	Columns
	Weight	Weight	Closure	C x D	Limited	C x F	Status Quo	C x H	Expanded	C x J	Maximum	C x L
Investment	1.15											
Jobs	1.52											
Privatization	1.70											
Consumer	1.76											
Taxpayer Cost	1.84											
Oregon Control	1.91											
Genetic Int.	2.08											
Nat.Production	2.44											
Maint.Benefits	2.53											
Expand benefits	2.69											
Weighted Points												
* FOR EACH CATAGORY POINTS SHOULD ADD UP TO 50.												

C. ODFW Policy

As we have seen, ODFW has little in the way of formal policy supporting private Salmon Ranching. However, that does not mean that their policies will not impact the which scenario the future will bring. It would appear to us that ODFW actions that would effectively favor private salmon ranching's expansion are:

1. A policy statement, supported by actions, defining ODFW's long term support of private salmon ranching as a concept.

2. The development of a "Propagation and Harvest" program that would effectively integrate private ocean ranching and the state's programs. Such a program might include:

   a. Management, and other, trade-offs for production level guarantees from the private salmon ranchers.

   b. A policy that quantifies acceptable straying at levels that are realistic both as percentages and as total numbers.

   c. Long-term release approval commitments from the state so as to avoid annual renegotiations.

   d. Research programs providing a balanced evaluation of problems common to state and private facilities such as stock selection, straying, survival rates, and genetic impacts.

   e. Research into the decline of coastal rivers in salmon production.

3. An increased sensitivity, by ODFW, of the impacts of their regulatory actions on the industry, especially as typified by the Coos Basin Plan decision.

To define the above policies that would support private salmon ranching is not to favor it. It is simply to say that if the state does these things it will improve the chances of expansion. If they don't it will improve the chances of the full closure scenario.

D. Nature's Impacts

At the end of Part 1, we put forth this verse:

The moon sinks from sight
The old dog's barking stops
A night's job done.

It describes a basic condition of salmon ranching of any kind, which is that man can project and postulate and do many things to direct success but in the end nature will decide what each season will bring. This is best illustrated by looking at Figure 15 which shows adult survival rates that vary from less than 1% to more than 6%. When taken with the way that the Private/Public harvest of private fish has varied (34% to 78%), a factor influenced both by man and nature, very large variations in what might come back up the ladder are easily visualized.

These impacts have been a serious factor in the growth of private salmon ranching in the past and they will be important in the choice of scenarios for the future.

Responses to Nature's Impacts that would favor expanded private salmon ranching would be:

1. A better understanding of the factors, especially upwelling conditions, that can improve adult survival for private salmon as compared to natural salmon in any given year. An example of this is discussed in Part 1:

> "1988 - Due to a series of natural events (floods and a late upwelling condition) the runs of naturally spawning salmon, especially pink and chum salmon in southeastern Alaska and Prince William Sound, are at very low levels. Most harvest activities are based on private non-profit (PNP) hatcheries with PNP harvest well in excess of 10 million fish."

The explanation put forth by the director of the FRED Division of the Alaska Fish and Game Department was the the PNP's monitored the upwelling conditions and held back their releases by 3-4 weeks when compared to the natural runs. In other word, the PNP's were able overcome nature's actions and provide a fishery in the face of general failure.

2. Better harvest management to reduce the variation in Private/Public harvest levels that occur in part because of varying distribution of stocks.

3. A willingness of investors to provide economic support to private salmon ranching in poor years and to establish reserves in good years.

4. A willingness of private ranchers to diversify, as some are now doing.

To define the above responses that would support private salmon ranching is not to favor it. It is simply to say that if these things are done they will improve the chances of expansion. If they aren't it will improve the chances of the full closure scenario.

E. Concern for Natural Production

This issue is frequently at the heart of disagreements over private salmon ranching both in terms of genetic impacts and straying impacts.

In terms of the genetic issue, we can say little more than was said in the discussion of that issue. It is hard to quantify and hard to find agreement. However, the genetic impacts of normal harvest management decisions are probably greater than impacts associated with hatchery releases at levels discussed here. Thus if we were to focus primarily on this issue it would seem that we should close private hatcheries, public hatcheries and eliminate fishing, with commercial fishing being the first to go. We certainly do no propose such steps but use this as a way to suggest that the issue is common to all of man's actions, not just private ocean ranching.

In any case, and as reserved above, genetic impact concerns would tend to mitigate towards less private salmon ranching.

The straying impacts on natural production would appear to be better suited to quantification. In Part 3 a series of criteria were assumed for "Maximum Impact" straying losses. These included the assumption of 4% "In-system" and 1% "Out-System" straying, a loss of 50 to 75 spawners for every 100 strays and the loss of one fish caught for each spawner loss.

The impact of these losses on the harvest for the various scenarios is illustrated on Figure 25. Under the "Maximum" scenario the total harvest is estimated to be about 1,500,000 fish (coho and chinook) and the stray losses are 38,000 fish (See boxes G73 and G74 in the "Economic Contribution Table" in the Appendix.). Under the "Closure" scenario the total harvest (with no stray losses) is 800,000 fish. Thus, if the assumptions are valid, the impact of stray losses is offset by about 20 to 1 by private hatchery production.

On this basis, this concern would tend to mitigate towards more private salmon ranching.

F. Economic Agreements

In Part 3 various state/private economic agreements are discussed that could improve the chances for the expansion of private salmon ranching. These include elements of the "Fair Rent" concept and the

"Free Market/Full Ownership" concept. These may not have practical significance to the selection of a scenario for private salmon ranching in that:

1. The "Fair Rent" concept will require adoption of specific harvest values and compensation that many will find impossible because of the difficulty of defining what the appropriate "numbers" are.

2. The "Free Market/Full Ownership" concept will require changes in public policy that are so fundamental and that have such implications at all levels of fishery resources management as to make their realization in the next 12 years beyond expectation.

Other economic agreements that may benefit private salmon ranching such as the state purchase of fish for release as part of their programs have more potential if policy matters could be settled and if both the state and the private ranchers could take a long term view. Recent efforts however, in this area were not successful.

G. Return on Investment and the Perception of Risks

Separate from many of the issues discussed elsewhere in this assessment is the question of the profitability and the normal business risk of private salmon ranching. These are clearly factors in the selection of a scenario. However, it is also clearly beyond this assessment to pass judgement on the potential for profit or the magnitude of risk. All we can say is this. Conditions which mitigate towards a reduction of risk and good economic returns also mitigate towards expansion of ocean ranching. However, they do not guarantee it.

H. The Economic Comparison of Scenarios

Figure 24 in Part 3, illustrates a comparison of economic impacts. The positive economic impact of the expanding scenarios would tend to mitigate towards more private salmon ranching.

I. Equivalent Public Investment

Figure 26 in Part 3, illustrates the public investment required to provide fish in quantities equivalent to various of the private ocean ranching scenarios. The high public investments required for higher levels of production as compared to the small public investment required in private ocean ranching would tend to mitigate towards more private salmon ranching.

J. Comparison of Public Harvest Levels

Figure 25 in Part 3, illustrates a comparison of public sport and troll harvest for the various scenarios. The scale of the impact of the expanding scenarios would tend to mitigate towards more private salmon ranching.

K. Individual Initiative

In Part 1 of this assessment, we said, in reference to the present extent of this industry:

> "With all due credit to the rest of the permittees in the state, the Oregon private ocean ranching program consist of only three substantial operations, Anadromous, Oregon Aqua-Foods, and Oregon Pacific Salmon Ranch."

This is a small number of firms and, as such, their survival is clearly not guaranteed by their numbers. However, it is more important to understand that the present industry is based on the interest and the initiative of a relatively few individuals whose numbers are not noticeably expanding. If the few individuals now involved give up their efforts for any reason and if they are not replaced in kind, the choice of the "Closure" scenario seems likely.

Why individuals might choose to stay involved or get involved varies greatly. While the profit motive may be part of it, it is seldom, in our opinion, a major factor. If it were, there would be no one left.

L. Harvest Management

The way that ODFW manages the harvest is of continuing concern by all involved in this question and it has been stated that somehow the private ocean ranching is making the problem worse. We have seen little evidence that this is the case though we have heard considerable apprehension of what might happen in the future. In many ways it would appear that this is an issue that is neutral on the question of "Less" versus "More" in private ocean ranching. On one hand is apprehension over future actions and on the other is more fish available for harvest under certain management scenarios.

M. The Prescriptive Solutions

When this study was undertaken, an aspect of the work was defined titled "prescriptive solutions". This was to be where actions would be defined that would lead to the desired results. The problem is that this assessment does not define "desired results". It can't. "Desired results" have varied in the past and will in the future. Each group and individual must chose their own.

When that choice is made the prescriptive solutions that will support them are easier to define. We will suggest here what they might be for some of the different desired results:

1. **Expansion** - For those who feel, after all has been said, that they would like to see private salmon ranching grow they should encourage these actions by the state and ODFW:

    1. Promulgate a policy statement, supported by actions, defining ODFW's long term support of private salmon ranching as a concept.

    2. Develop of a "Propagation and Harvest" program that would effectively integrate private ocean ranching and the state's programs. Such a program might include:

        a. Management, and other, trade-offs for production level guarantees from the private salmon ranchers.

        b. A policy that quantifies acceptable straying at levels that are realistic both as percentages and as total numbers.

        c. Long term release approval commitments from the state so as to avoid annual renegotiations.

        d. Research programs providing a balanced evaluation of problems common to state and private facilities such as stock selection, straying, survival rates, and genetic impacts.

        e. Research into the decline of coastal rivers in salmon production.

    3. Develop an increased sensitivity to the impacts of their regulatory actions on the industry, especially as typified by the Coos Basin Plan decision.

    4. Focus resources on improved harvest management consistency.

The ranchers should:

    1. Stabilize their programs.

    2. Improve their communications with the community and ODFW.

The coastal communities should, if this is the case, express support for private salmon ranching and the companies and individuals involved to ODFW and the legislature.

The fishermen should, if this is the case, express support or private salmon ranching as noted above and be willing to discuss mutually beneficial changes even where they appear to change traditions.

2. **Closure** - For those who feel, after all has been said, that they would like to see private salmon ranching fail they should encourage these actions:

The passage of increasingly restrictive legislation targeted on ocean ranching.

The conduct of high visibility public protest against private ocean ranching.

The publication and wide distribution of critical scientific publications.

3. **Status Quo** - Those who feel that they would like to see private salmon ranching maintain its status quo also must do something. At first glance it seems that the answer is for the community to go on doing what it has, which for many is nothing. However, after some consideration, we believe that to maintain the present level of operation it is not enough to do nothing.

Private Salmon Ranching in Oregon would appear to be on the decline. This has been brought about by a variety of factors, natural and manmade and while hope is still there for those who support the concept the signs are discouraging. Releases are declining and stated company policies are to move into areas that require smaller releases.

To reverse the decline, and perhaps even to maintain the status quo will require many of the same steps as suggested above for the expansion option.

N. The Choice of Scenarios & The Assessment

We have made no choice of scenarios. Where private ocean ranching goes in the future depends on what scenario people want to support and then on how willing they are to support that choice with action. However, we would like to summarize our assessment of where ocean ranching is today in the State of Oregon.

We have heard it said that over $80 million dollars has been invested in private ocean ranching in Oregon in the last 15 years and we do not doubt the estimates. As a result there have been a number of technical successes and much has been learned. More important, as a result of these investments, there is significant public support for private ocean ranching from those who believe it is, on balance, good for the state and especially good for the coastal communities. This is supported by most of the issues and factors considered in this assessment.

Even the detractors, taken as a group, are probably more supportive than they were in the past and there are few that are informed on the issues that will seriously propose that all private ocean ranching operations be closed as a matter of public policy.

Yet closure is well within the realm of possibility. It can be argued, though not yet proven, that the basic economics make this inevitable but there is little question that improved state support is a factor in the balance between continuation or failure.

The form that this support might take is suggested above in simplistic terms in the discussion of "ODFW Policy" in Part 4 but, unfortunately, this is not a simple, one-shot, solution that can or will be imposed by ODFW. Survival of private ocean ranching in Oregon also requires an improved level of support, effectively demonstrated, from legislators, the governor, businesses, local officials, private citizens, and anyone else who wants it to continue. Even with such support, survival may not be possible but for them to let failure occur without trying would be irresponsible.

This is not to say that the private ocean ranchers have always performed in ways that invite support. Early expectations, still unfulfilled, continue to be put forth by a few as certainties. Public criticism of ODFW fish propagation operations, growing out of competitive instincts rather that reasonable expectations, has created unnecessary antagonism that does not contribute to support in other areas. Perhaps more attention should be paid to inviting support and less to forcing it.

We must also recognize that the arguments, pro and con, over ocean ranching have fallen into the hands of only a few individuals, the insiders. The have become so acquainted with the issues and so articulate in defending their long held positions that others, the outsiders, are shut out of the discussion. We hope that this assessment will help the outsiders take part in the decisions to be made for ocean ranching and to do so on an informed basis.

Appendix

The following four tables provide statistical background for various parts of the text. They are:

1. **Coho Balance Master** - Which summarized state and private return and released data and derives various factors. Typically the data are directly from ODFW sources. Other values are calculated generally using the same "Harvest Rate" methods as typically used by ODFW in their distribution calculations. The separation of the catch contribution values for the public coastal hatcheries is based on the general harvest rate values applied to the combined hatchery return and the estimates for in-stream harvest of public hatchery fish. The in-stream harvest values are generally total in-stream harvest less lake and stream values. Some adjustments for reported terminal harvest of private coho are included.

2. **Economic Contribution Table** - Is a summary of the economic contributions of the various scenarios for private salmon ranching development.

3. **Economic Contrib. Table II** - Is a calculation of the investments required to equal the public contributions of the various scenarios for private salmon ranching development.

4.**Planting Master** - Is a summary of the private hatchery planting data.

5. **Returns Master** - Is a summary of returns to the hatcheries.

Coho Balance Master

	A	B	C	D	E	F	G	H	I	J	K	L
1	All Oregon Smolt Sources:									Coastal		Return%
2			Private	Troll	Sport	Total				Spawned	Catch	OPI
3			Ocean	Ocean	Ocean	Ocean	Columbia	Coastal		or Used	Ratio	Catch+
4			Catch	Catch	Catch	Catch	Escape-	Escape-	Coastal	for	%	Escap.)
5		Smolts	Outside	Inside	Inside	Inside	ment	ment	Fresh-	Ocean	(Harvest/	Div. by
6		Entering	OPI	OPI	OPI	OPI	+Fliver	to	water	Ranching	OPI Harv.	last
7		Ocean	Area	Area	Area	Area	Catch	River	Catch	Harvest	+Escape-	years
8	Year	millions	1000's	1000's	1000's	1000's	1000's	1000's	1000's	1000's	ment)	release)
9			Note 1	Note 2	Note 2	Note 3	Note 2	Note 4	Note 5	Note 6	Note 7	
10	1969											
11	1970			1,394	475	1,869	872	330	40	290	61%	
12	1971			2,422	682	3,104	524	378	24	354	77%	
13	1972			1,215	534	1,749	269	158	17	141	80%	
14	1973			1,257	422	1,680	284	205	15	189	77%	
15	1974			1,995	637	2,632	453	183	14	169	81%	
16	1975			1,028	442	1,469	292	178	14	165	76%	
17	1976			2,796	931	3,727	326	225	20	205	87%	
18	1977		0	633	393	1,025	87	93	14	80	85%	
19	1978		4	1,052	500	1,551	297	102	5	97	80%	
20	1979		25	1,006	319	1,325	264	250	2	249	72%	
21	1980		9	483	501	984	285	181	6	175	68%	
22	1981		34	789	328	1,117	162	229	10	219	74%	
23	1982		23	691	272	964	436	354	15	339	55%	
24	1983		107	401	261	662	97	212	7	205	68%	
25	1984		18	85	176	260	405	374	17	357	25%	
26	1985		29	132	264	397	352	570	16	554	30%	
27	1986		36	578	296	873	1,514	732	38	694	28%	
28	1987		11	430	286	715	267	251	15	237	58%	
29	85-87		25	380	282	662	711	518	23	495	39%	
30	Private Ranched Salmon											
31		Note 8	Note 1	Note 9	Note 10	Note 1		Note 11	Note 12	Note 13	Note 7	Note 14
32	1969	.0										
33	1970	.0										
34	1971	.0										
35	1972	.0										
36	1973	.0										
37	1974	.1										
38	1975	.1	0	0	0	0				0		0.00%
39	1976	2.1	0	0	0	0				0		0.00%
40	1977	2.4	0	5	3	8		4	0	4	66%	0.59%
41	1978	9.9	4	15	7	22		12	0	12	64%	1.41%
42	1979	5.8	25	31	10	40		49	0	49	45%	0.91%
43	1980	14.8	9	22	23	44		39	0	39	53%	1.43%
44	1981	23.9	34	102	42	145		118	1	118	55%	1.78%
45	1982	23.1	23	88	35	122		186	1	185	40%	1.29%
46	1983	16.1	107	82	53	135		135	1	134	50%	1.17%
47	1984	10.9	18	3	7	10		117	2	115	8%	0.79%
48	1985	8.6	29	21	42	63		339	7	332	16%	3.69%
49	1986	8.7	36	63	32	95		472	18	454	17%	6.59%
50	1987	4.6	11	102	68	170		124	5	119	58%	3.38%
51	85-87	7.3	25	62	47	109		312	10	302	30%	4.55%

Coho Balance Master

	A	B	C	D	E	F	G	H	I	J	K	L
52	All Except Private Hatcheries											Return%
53				Troll	Sports	Total				Spawned	Catch	OPI
54				Ocean	Ocean	Ocean	Columbia	Coastal		or Used	Ratio	Catch+
55				Catch	Catch	Catch	Escape-	Escape-	Coastal	for	%	Escap.)
56		Smolts		Inside	Inside	Inside	ment	ment	Fresh-	Ocean	(Harvest/	Div. by
57		Entering		OPI	OPI	OPI	+River	to	water	Ranching	OPI Harv.	last
58		Ocean		Area	Area	Area	Catch	River	Catch	Harvest	+Escape-	years
59	Year	millions		1000's	1000's	1000's	1000's	1000's	1000's	1000's	ment)	release)
60				Note 9	Note 10	Note 15	Note 2	Note 15	Note 15	Note 15	Note 7	
61	1969											
62	1970			1,394	475	1,869	872	330	40	290	61%	
63	1971			2,422	682	3,104	524	378	24	354	77%	
64	1972			1,215	534	1,749	269	158	17	141	80%	
65	1973			1,257	422	1,680	284	205	15	189	77%	
66	1974			1,995	637	2,632	453	183	14	169	81%	
67	1975			1,028	442	1,469	292	178	14	165	76%	
68	1976			2,796	931	3,727	326	225	20	205	87%	
69	1977			628	389	1,017	87	89	13	76	85%	
70	1978			1,037	493	1,530	297	89	4	85	80%	
71	1979			976	309	1,285	264	201	1	200	73%	
72	1980			461	479	940	285	142	6	136	69%	
73	1981			687	285	972	162	110	9	101	78%	
74	1982			604	238	841	436	168	14	154	58%	
75	1983			319	207	527	97	76	5	71	75%	
76	1984			81	169	250	405	257	16	241	27%	
77	1985			111	222	333	352	231	9	222	36%	
78	1986			515	264	778	1,514	260	20	240	30%	
79	1987			328	218	545	267	127	10	117	58%	
80	85-87			318	235	552	711	206	13	193	42%	
81	Coastal Public Hatcheries											
82		Note 16		Note 9	Note 10	Note 17		Note 11	Note 18	Note 19	Note 20	Note 14
83	1969	3.4										
84	1970	3.4		77	26	104		67	26	41	61%	5.02%
85	1971	4.1		122	34	157		46	16	30	77%	5.96%
86	1972	3.8		69	30	100		24	11	13	80%	3.02%
87	1973	3.9		95	32	127		37	10	27	77%	4.32%
88	1974	4.1		141	45	186		45	9	36	81%	5.92%
89	1975	3.4		32	14	46		15	9	6	76%	1.47%
90	1976	4.0		284	94	378		56	13	43	87%	12.77%
91	1977	3.2		60	37	96		17	9	8	85%	2.83%
92	1978	4.0		30	14	44		11	3	8	80%	1.73%
93	1979	4.5		56	18	74		27	1	26	73%	2.52%
94	1980	3.4		30	31	61		28	2	26	69%	1.98%
95	1981	3.9		75	31	107		30	6	24	78%	4.01%
96	1982	4.3		33	13	46		33	10	23	58%	2.01%
97	1983	3.0		28	18	46		15	4	11	75%	1.42%
98	1984	4.5		5	11	16		43	9	34	27%	1.98%
99	1985	3.8		6	13	19		34	4	30	36%	1.18%
100	1986	4.8		19	10	28		64	15	49	30%	2.44%
101	1987	4.9		35	23	58		42	5	37	58%	2.10%
102	85-87	4.5		20	15	35		47	8	39	42%	1.91%

Coho Balance Master

	A	B	C	D	E	F	G	H	I	J	K	L
103	Coastal Natural Streams Stocks											
104				Troll	Sports	Total				Spawned	Catch	
105				Ocean	Ocean	Ocean		Coastal		or Used	Ratio	
106				Catch	Catch	Catch		Escape-	Coastal	for	%	
107				Inside	Inside	Inside		ment	Fresh-	Ocean	(Harvest/	
108				OPI	OPI	OPI		to	water	Ranching	OPI Harv.	
109				Area	Area	Area		River	Catch	Harvest	+Escape-	
110	Year			1000's	1000's	1000's		1000's	1000's	1000's	ment)	
111				Note 9	Note 10	Note 17		Note 11	Note 21	Note 22	Note 20	
112	1969											
113	1970			280	95	375		241	13	229	61%	
114	1971			807	227	1,034		301	7	293	77%	
115	1972			347	152	500		122	5	117	80%	
116	1973			382	128	510		148	5	144	77%	
117	1974			410	131	541		131	4	126	81%	
118	1975			343	147	490		157	4	153	76%	
119	1976			829	276	1,105		163	6	157	87%	
120	1977			233	145	378		65	4	61	85%	
121	1978			197	94	291		74	1	72	80%	
122	1979			351	111	462		167	0	167	73%	
123	1980			116	121	237		108	4	104	69%	
124	1981			185	77	261		73	3	71	78%	
125	1982			128	50	178		128	3	125	58%	
126	1983			104	68	172		57	1	56	75%	
127	1984			24	51	75		199	5	194	27%	
128	1985			36	71	107		188	4	183	36%	
129	1986			53	27	80		183	4	179	30%	
130	1987			65	44	109		79	4	74	58%	
131	85-87			51	47	99		150	4	146	42%	
132	Coastal Natural Lake Stocks											
133				Note 9	Note 10	Note 17		Note 11	Note 23	Note 24	Note 20	
134	1969											
135	1970			25	9	34		22	1	21	61%	
136	1971			85	24	109		32	1	31	77%	
137	1972			32	14	47		11	1	11	80%	
138	1973			50	17	67		19	1	19	77%	
139	1974			23	7	30		7	0	7	81%	
140	1975			15	6	21		7	1	6	76%	
141	1976			28	9	37		6	0	5	87%	
142	1977			25	16	41		7	0	7	85%	
143	1978			13	6	19		5	0	5	80%	
144	1979			14	5	19		7	0	7	73%	
145	1980			7	8	15		7	0	7	69%	
146	1981			18	8	26		7	1	7	78%	
147	1982			8	3	11		8	0	7	58%	
148	1983			9	6	14		5	0	4	75%	
149	1984			2	4	6		15	2	14	27%	
150	1985			2	4	5		10	0	9	36%	
151	1986			4	2	5		12	0	12	30%	
152	1987			5	3	8		6	0	6	58%	
153	85-87			3	3	6		9	0	9	42%	

Coho Balance Master

	A	B	C	D	E	F	G	H	I	J	K	L
154	Coastal Natural & Coastal Public Hatchery											
155			Private	Troll	Sports	Total				Spawned	Catch	
156			Ocean	Ocean	Ocean	Ocean	Columbia	Coastal		or Used	Ratio	
157			Catch	Catch	Catch	Catch	Escape-	Escape-	Coastal	for	%	
158		Smolts	Outside	Inside	Inside	Inside	ment	ment	Fresh-	Ocean	(Harvest/	
159		Entering	OPI	OPI	OPI	OPI	+River	to	water	Ranching	OPI Harv.	
160		Ocean	Area	Area	Area	Area	Catch	River	Catch	Harvest	+Escape-	
161	Year	millions	1000's	1000's	1000's	1000's	1000's	1000's	1000's	1000's	ment)	
162				Note 25	Note 25	Note 25		Note 11	Note 25	Note 25	Note 7	
163	1969											
164	1970			382	130	513		330	40	290	61%	
165	1971			1,015	285	1,300		378	24	354	77%	
166	1972			449	197	646		158	17	141	80%	
167	1973			527	177	703		205	15	189	77%	
168	1974			574	183	757		183	14	169	81%	
169	1975			389	167	557		178	14	165	76%	
170	1976			1,140	380	1,520		225	20	205	87%	
171	1977			318	197	515		89	13	76	85%	
172	1978			240	114	354		89	4	85	80%	
173	1979			422	133	555		201	1	200	73%	
174	1980			154	160	313		142	6	136	69%	
175	1981			278	115	393		110	9	101	78%	
176	1982			168	66	234		168	14	154	58%	
177	1983			141	91	232		76	5	71	75%	
178	1984			32	65	97		257	16	241	27%	
179	1985			44	88	132		231	9	222	36%	
180	1986			75	39	114		260	20	240	30%	
181	1987			106	70	176		127	10	117	58%	
182	85-87			75	66	141		206	13	193	42%	
183	Columbia River											
184				Note 26	Note 26	Note 26	Note 26					
185	1969											
186	1970			1,012	345	1,356	872					
187	1971			1,408	396	1,804	524					
188	1972			766	336	1,103	269					
189	1973			731	245	976	284					
190	1974			1,422	454	1,875	453					
191	1975			638	274	913	292					
192	1976			1,656	551	2,207	326					
193	1977			310	192	503	87					
194	1978			797	379	1,176	297					
195	1979			554	175	730	264					
196	1980			307	319	627	265					
197	1981			409	170	579	162					
198	1982			436	171	607	436					
199	1983			178	116	294	97					
200	1984			50	103	153	405					
201	1985			67	134	201	352					
202	1986			439	225	664	1,514					
203	1987			222	148	370	267					
204	85-87	.0	0	243	169	412	711	0	0	0	0%	

Coho Balance Master

	A	B	C	D	E	F	G	H	I	J	K	L
205												
206	Note 1-Table 1, "Fishery Contribution of Coho Salmon Released from Oregon Coastal Private Hatcheries',											
207	Steve Jacobs, Fish Division, ODFW, May, 1988.											
208	Note 2-Table III-5, "Review of 1987 Ocean Salmon Fisheries", Pacific Fishery Management Council, February, 1988.											
209	Note 3-Total of Sport and Troll Catch. (Columns D&E)											
210	Note 4-Columns I&J.											
211	Note 5-Column T, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
212	Note 6-Total of Private Ranched Salmon, Coastal Public Hatcheries, Coastal Natural Stream Stocks, and											
213	Coastal Natural Lake Stocks.											
214	Note 7-Column F divided by Columns F, G, & H.											
215	Note 8-See Planting Master Table.											
216	Note 9-Column F-Column E.											
217	Note 10-(Total Sport Catch/Total Catch (all sources)) x Column F.											
218	Note 11-Columns I+J											
219	Note 12-See Table 2-Returns											
220	Note 13-Column AB, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
221	Note 14-This year's Columns J, I, & F divided by last year's releases (Column B)											
222	Note 15-Total less Private Hatcheries											
223	Note 16-Update (provided by Harry Wagner, ODFW) of Table 5 of the "Coho Salmon Plan Status Report"											
224	dated, Feb.1, 1985 by ODFW.											
225	Note 17-(Col.H/(1-Col.K))-Col.H)											
226	Note 18-Total-Private and Natural Lakes and Stream Values											
227	Note 19-Column S, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
228	Note 20-Same as "All Except Private Hatcheries".											
229	Note 21-Column B, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
230	Note 22-Column U, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
231	Note 23-Column g, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
232	Note 24-Column V, "Updated OPI Area Historical Coho Data Base", Don Bodenmiller, ODFW, July 12, 1988.											
233	Note 25-Total of Natural Lake and Stream and Coastal Public Hatcheries.											
234	Note 26-Total less Private, Public Coastal, Coastal Natural Lakes & Streams.											
235												
236												
237												
238												
239												
240												
241												
242												
243												
244												
245												
246												
247												
248												
249												
250												
251												
252												
253												
254												
255												

An Assessment of Private Salmon Ranching in Oregon

Economic Contribution Table

	A	B	C	D	E	F	G
1				Limited	Status	Expanded	Maximum
2			Closure	Operation	Quo	Operation	Operation
3			Scenario	Scenario	Scenario	Scenario	Scenario
4							
5	Coho Released (Millions)	Anadromous	.0	.5	1.0	6.0	11.3
6	Chinook Released (Millions)	Anadromous	.0	1.5	3.0	6.0	9.4
7	Coho Released (Millions)	Domsea	.0	.0	.0	6.0	12.0
8	Chinook Released (Millions)	Domsea	.0	.0	.0	6.0	12.0
9	Coho Released (Millions)	OAF	.0	.5	4.0	6.0	9.5
10	Chinook Released (Millions)	OAF	.0	1.5	4.0	6.0	10.6
11	Coho Released (Millions)	Oregon Pacific	.0	.0	.0	.0	.0
12	Chinook Released (Millions)	Oregon Pacific	.0	.8	1.0	2.0	5.0
13	Baseline Coho Survival %	All	4.00%	4.00%	4.00%	4.00%	4.00%
14	Baseline Chinook Survival %	All	2.60%	2.60%	2.60%	2.60%	2.60%
15	Coho Survival this Calculation	All	4.00%	4.00%	4.00%	4.00%	4.00%
16	Chinook Survival this Calculation	All	2.60%	2.60%	2.60%	2.60%	2.60%
17	Private Coho Survival (1000's)	Anadromous	0	20	40	240	452
18	Private Chinook Survival (1000's)	Anadromous	0	39	78	156	244
19	Private Coho Survival (1000's)	Domsea	0	0	0	240	480
20	Private Chinook Survival (1000's)	Domsea	0	0	0	156	312
21	Private Coho Survival (1000's)	OAF	0	20	160	240	380
22	Private Chinook Survival (1000's)	OAF	0	39	104	156	276
23	Private Coho Survival (1000's)	Oregon Pacific	0	0	0	0	0
24	Private Chinook Survival (1000's)	Oregon Pacific	0	21	26	52	130
25	Return to Hatcheries	All	55%	55%	55%	55%	55%
26	Private Coho to Hatcheries (1000's)	Anadromous	0	11	22	132	249
27	Private Chinook to Hatcheries (1000's)	Anadromous	0	21	43	86	134
28	Private Coho to Hatcheries (1000's)	Domsea	0	0	0	132	264
29	Private Chinook to Hatcheries (1000's)	Domsea	0	0	0	86	172
30	Private Coho to Hatcheries (1000's)	OAF	0	11	88	132	209
31	Private Chinook to Hatcheries (1000's)	OAF	0	21	57	86	152
32	Private Coho to Hatcheries (1000's)	Oregon Pacific	0	0	0	0	0
33	Private Chinook to Hatcheries (1000's)	Oregon Pacific	0	11	14	29	72
34	Private Coho to Hatcheries (1000's)	All	0	22	110	396	722
35	Private Chinook to Hatcheries (1000's)	All	0	54	114	286	529
36	"In-System" Strays	All	4.00%	4.00%	4.00%	4.00%	4.00%
37	Private Coho "In-System" Strays	Anadromous	0	440	880	5280	9944
38	Private Chinook "In-System" Strays	Anadromous	0	858	1716	3432	5377
39	Private Coho "In-System" Strays	Domsea	0	0	0	5280	10560
40	Private Chinook "In-System" Strays	Domsea	0	0	0	3432	6864
41	Private Coho "In-System" Strays	OAF	0	440	3520	5280	8360
42	Private Chinook "In-System" Strays	OAF	0	858	2288	3432	6063
43	Private Coho "In-System" Strays	Oregon Pacific	0	0	0	0	0
44	Private Chinook "In-System" Strays	Oregon Pacific	0	458	572	1144	2860
45	"In&Out-System" Stray Impact 0=Min., 1=Max.	All	1	1	1	1	1
46	"In-Sys." Loss per Stray	All	0.75	0.75	0.75	0.75	0.75
47	"In-System" Coho Spawners (In This Drainage)	Anadromous	8,900	8,900	8,900	8,900	8,900
48	"In-System" Chinook Spawners (In This Drainage)	Anadromous	7,600	7,600	7,600	7,600	7,600
49	"In-System" Coho Spawners (In This Drainage)	Domsea	20,900	20,900	20,900	20,900	20,900
50	"In-System" Chinook Spawners (In This Drainage)	Domsea	4,000	4,000	4,000	4,000	4,000
51	"In-System" Coho Spawners (In This Drainage)	OAF	10,300	10,300	10,300	10,300	10,300
52	"In-System" Chinook Spawners (In This Drainage)	OAF	1,900	1,900	1,900	1,900	1,900
53	"In-System" Coho Spawners (In This Drainage)	Oregon Pacific	0	0	0	0	0
54	"In-System" Chinook Spawners (In This Drainage)	Oregon Pacific	0	0	0	0	0
55	"In-System" Coho Losses due to Stray	Anadromous	0	330	660	3,960	7,458
56	"In-System" Chinook Losses due to Stray	Anadromous	0	644	1,287	2,574	4,033
57	"In-System" Coho Losses due to Stray	Domsea	0	0	0	3,960	7,920
58	"In-System" Chinook Losses due to Stray	Domsea	0	0	0	2,574	4,000
59	"In-System" Coho Losses due to Stray	OAF	0	330	2,640	3,960	6,270
60	"In-System" Chinook Losses due to Stray	OAF	0	644	1,716	1,900	1,900
61	"In-System" Coho Losses due to Stray	Oregon Pacific	0	0	0	0	0
62	"In-System" Chinook Losses due to Stray	Oregon Pacific	0	0	0	0	0
63	"Out-System" Strays	All	1.00%	1.00%	1.00%	1.00%	1.00%
64	"Out-System" Losses per Strays	All	50%	50%	50%	50%	50%
65	"Out-System" Coho Losses due to Stray	Anadromous	0	55	110	660	1,243
66	"Out-System" Chinook Losses due to Stray	Anadromous	0	107	215	429	672
67	"Out-System" Coho Losses due to Stray	Domsea	0	0	0	660	1,320
68	"Out-System" Chinook Losses due to Stray	Domsea	0	0	0	429	858
69	"Out-System" Coho Losses due to Stray	OAF	0	55	440	660	1,045
70	"Out-System" Chinook Losses due to Stray	OAF	0	107	286	429	758
71	"Out-System" Coho Losses due to Stray	Oregon Pacific	0	0	0	0	0
72	"Out-System" Chinook Losses due to Stray	Oregon Pacific	0	57	72	143	358
73	Estimated Coho Stray Losses (1000's)	All	.0	.8	3.9	13.9	25.3
74	Estimated Chinook Stray Losses (1000's)	All	.0	1.6	3.6	8.5	12.6
75	Baseline Coho "Natural" Harvest Contribution (1000's)		105.0	105.0	105.0	105.0	105.0

An Assessment of Private Salmon Ranching in Oregon

Economic Contribution Table

	A	B	C	D	E	F	G
76	Baseline Chinook "Natural" Harvest Contribution (1000's)		135.0	135.0	135.0	135.0	135.0
77	Baseline "Other" Coho Harvest Contribution (1000's)		448.0	448.0	448.0	448.0	448.0
78	Baseline "Other" Chinook Harvest Contribution (1000's)		270.0	270.0	270.0	270.0	270.0
79	This Year Coho "Natural" Harvest Contribution (1000's)		105.0	105.0	105.0	105.0	105.0
80	This Year Chinook "Natural" Harvest Contribution (1000's)		135.0	135.0	135.0	135.0	135.0
81	This Year "Other" Coho Harvest Contribution (1000's)		448.0	448.0	448.0	448.0	448.0
82	This Year "Other" Chinook Harvest Contribution (1000's)		270.0	270.0	270.0	270.0	270.0
83	Adjusted "Natural" Coho Harvest Contribution	All	105.0	104.2	101.2	91.1	79.7
84	Adjusted "Natural" Chinook Harvest Contribution	All	135.0	133.4	131.4	126.5	122.4
85	"Total" Public Coho OPI Harvest Contrib. (1000's)	All	553.0	552.2	549.2	539.1	527.7
86	"Total" Public Chinook Harvest Contribution (1000's)	All	405.0	403.4	401.4	396.5	392.4
87	Private Coho Harvest Contribution (1000's)	Anadromous	0	9	18	108	203
88	Private Chinook Harvest Oregon Contrib. (1000's)	Anadromous	0	18	35	70	110
89	Private Coho Harvest Contribution (1000's)	Domsea	0	0	0	108	216
90	Private Chinook Harvest Oregon Contrib. (1000's)	Domsea	0	0	0	70	140
91	Private Coho Harvest Contribution (1000's)	OAF	0	9	72	108	171
92	Private Chinook Harvest Oregon Contrib. (1000's)	OAF	0	18	47	70	124
93	Private Coho Harvest Contribution (1000's)	Oregon Pacific	0	0	0	0	0
94	Private Chinook Harvest Oregon Contrib. (1000's)	Oregon Pacific	0	9	12	23	59
95	"Total" Private Coho OPI Harvest Contrib. (1000's)		0	18	90	324	590
96	"Total" Private Chinook Harvest Oregon Contrib. (1000's)		0	44	94	234	433
97	Publ.&Priv. Coho OPI Harvest Contrib. (1000's)		553	570	639	863	1118
98	Publ.&Priv. Coho Oregon Sport Contrib. (1000's)		165	167	172	191	212
99	Publ.&Priv. Coho Oregon Troll Contrib. (1000's)		235	244	278	387	512
100	Private Coho Troll Contribution (1000's)		0	8	39	145	270
101	Public Coho Troll Contribution (1000's)		235	236	238	242	242
102	Publ.&Priv.Chinook Oregon Harvest Contrib (1000's)		405	448	495	631	825
103	Publ.&Priv.Chinook Oregon Sport Contrib (1000's)		51	55	58	69	84
104	Publ.&Priv.Chinook Oregon Troll Contrib (1000's)		354	393	437	562	741
105	Private Chinook Oregon Troll Contrib (1000's)		0	39	83	208	389
106	Public Chinook Oregon Troll Contrib (1000's)		354	354	354	353	353
107	Total Sports Harvest in Oregon (Coho&Chin.)-(1000's)		217	222	231	260	296
108	Oregon Angler Days for Recreational Fishing		246249	246712	247621	250444	253963
109							
110	Ave. Weight Coho Returns to Priv. Hatchery #'s Each		5.5	5.5	5.5	5.5	5.5
111	Ave. Weight Chinook Returns to Priv. Hatchery #'s Each		10.1	10.1	10.1	10.1	10.1
112	Average Weight Troll Harvested Coho #'s Each		5.0	5.0	5.0	5.0	5.0
113	Average Weight Troll Harvested Chinook #'s Each		9.0	9.0	9.0	9.0	9.0
114							
115	Pounds of Coho Returning to Private Hatcheries (1000's)		0	121	605	2,178	3,989
116	Pounds of Chinook Returning to Private Hatcheries (1000's)		0	549	1,155	2,889	5,344
117	Pounds of Coho Harvested in Oregon (1000's)		1,177	1,219	1,388	1,935	2,559
118	Pounds of Chinook Harvested in Oregon (1000's)		3,182	3,538	3,929	5,055	6,673
119	Oregon Angler Days for Recreational Fishing		246,249	246,712	247,621	250,444	253,963
120							
121	Economic Value of Coho Returning to Private Hatchery/#		$1.71	$1.71	$1.71	$1.71	$1.71
122	Economic Value of Chinook Returning to Private Hatchery/#		$2.66	$2.66	$2.66	$2.66	$2.66
123	Economic Value of Coho Caught in Comm. Fishery/#		$3.46	$3.46	$3.46	$3.46	$3.46
124	Economic Value of Chinook Caught in Comm. Fishery/#		$5.77	$5.77	$5.77	$5.77	$5.77
125	Economic Value/Angler Day		$52	$52	$52	$52	$52
126							
127	Economic Value of Coho Returning to Private Hatchery		$0	$206910	$1034550	$3724380	$6786648
128	Economic Value of Chinook Returning to Private Hatchery		$0	$1459898	$3073470	$7683676	$14214801
129	Economic Value of Coho Caught in Comm. Fishery		$4072714	$4218475	$4801517	$6696405	$8853663
130	Economic Value of Chinook Caught in Comm. Fishery		$18358034	$20414353	$22673057	$29187617	$38504647
131	Economic Value of Recreational Fishery		$12804971	$12829005	$12876296	$13023063	$13206060
132							
133							
134							
135							
136							
137	Scenario (Assuming Maximum Straying Impact)		Closure	Limited	Status Quo	Expanded	Maximum
138	Total Economic Value of Scenario ($Millions)	Total	$35.2	$39.1	$44.5	$60.3	$81.6
139	Increased Economic Value Over Closure Scenario ($Millions)	Priv.Contributi	$0.0	$3.9	$9.2	$25.1	$46.3
140							
141							
142	Scenario (Assuming Minimum, i.e. "0", Straying Impact)		Closure	Limited	Status Quo	Expanded	Maximum
143	Total Economic Value of Scenario ($Millions)	Total	$35.2	$39.2	$44.7	$60.8	$82.4
144	Increased Economic Value Over Closure Scenario ($Millions)	Priv.Contributi	$0.0	$4.0	$9.4	$25.6	$47.2
145							
146			Closure	Limited	Status Quo	Expanded	Maximum
147	Total Oregon Sport Coho & Chinook Harvest	Oregon Sport	218,831	221,547	230,827	259,628	295,538
148	Total Oregon Troll Coho & Chinook Harvest	Oregon Troll	588,932	636,955	714,152	948,747	1,253,245
149	Total Stray Losses	Max.Stray Los	0	2,329	7,425	22,338	37,834

Economic Contrib.Table II

	A	B	C	D	E	F	G
1				Limited	Status	Expanded	Maximum
2		Assumed	Closure	Operation	Quo	Operation	Operation
3		Location	Scenario	Scenario	Scenario	Scenario	Scenario
4							
5	Coho Released to Equal Private Scenario (Millions)	Site 1	0.000	0.135	0.680	2.440	4.445
6	Chinook Released to Equal Private Scenario (Millions)	Site 1	0.000	0.519	1.090	2.730	5.086
7	Coho Released to Equal Private Scenario (Millions)	Site 2	0.000	0.135	0.680	2.440	4.445
8	Chinook Released to Equal Private Scenario (Millions)	Site 2	0.000	0.519	1.090	2.730	5.086
9	Coho Released to Equal Private Scenario (Millions)	Site 3	0.000	0.135	0.680	2.440	4.445
10	Chinook Released to Equal Private Scenario (Millions)	Site 3	0.000	0.519	1.090	2.730	5.086
11	Coho Released to Equal Private Scenario (Millions)	Site 4	0.000	0.135	0.680	2.440	4.445
12	Chinook Released to Equal Private Scenario (Millions)	Site 4	0.000	0.519	1.090	2.730	5.086
13	Baseline Coho Survival %	All	4.00%	4.00%	4.00%	4.00%	4.00%
14	Baseline Chinook Survival %	All	2.60%	2.60%	2.60%	2.60%	2.60%
15	Coho Survival this Calculation	All	4.00%	4.00%	4.00%	4.00%	4.00%
16	Chinook Survival this Calculation	All	2.60%	2.60%	2.60%	2.60%	2.60%
17	Release Site Coho Survival (1000's)	Site 1	0	5	27	98	178
18	Release Site Chinook Survival (1000's)	Site 1	0	13	28	71	132
19	Release Site Coho Survival (1000's)	Site 2	0	5	27	98	178
20	Release Site Chinook Survival (1000's)	Site 2	0	13	28	71	132
21	Release Site Coho Survival (1000's)	Site 3	0	5	27	98	178
22	Release Site Chinook Survival (1000's)	Site 3	0	13	28	71	132
23	PrivateRelease Site	Site 4	0	5	27	98	178
24	Release Site Chinook Survival (1000's)	Site 4	0	13	28	71	132
25	Return to Release Site	All	20%	20%	20%	20%	20%
26	Release Site Coho to Hatcheries (1000's)	Site 1	0	1	5	20	36
27	Release Site Chinook to Hatcheries (1000's)	Site 1	0	3	6	14	26
28	Release Site Coho to Hatcheries (1000's)	Site 2	0	1	5	20	36
29	Release Site Chinook to Hatcheries (1000's)	Site 2	0	3	6	14	26
30	Release Site Coho to Hatcheries (1000's)	Site 3	0	1	5	20	36
31	Release SiteChinook to Hatcheries (1000's)	Site 3	0	3	6	14	26
32	Release Site Coho to Hatcheries (1000's)	Site 4	0	1	5	20	36
33	Release Site Chinook to Hatcheries (1000's)	Site 4	0	3	6	14	26
34	Release Site Coho to Hatcheries (1000's)	All	0	4	22	78	142
35	Release Site Chinook to Hatcheries (1000's)	All	0	11	23	57	106
36	"In-System" Strays	All	4.00%	4.00%	4.00%	4.00%	4.00%
37	Release Site Coho "In-System" Strays	Site 1	0	43	218	781	1422
38	Release Site Chinook "In-System" Strays	Site 1	0	108	227	568	1058
39	Release Site Coho "In-System" Strays	Site 2	0	43	218	781	1422
40	Release Site Chinook "In-System" Strays	Site 2	0	108	227	568	1058
41	Release Site Coho "In-System" Strays	Site 3	0	43	218	781	1422
42	Release Site Chinook "In-System" Strays	Site 3	0	108	227	568	1058
43	Release Site Coho "In-System" Strays	Site 4	0	43	218	781	1422
44	Release Site Chinook "In-System" Strays	Site 4	0	108	227	568	1058
45	"In&Out-System" Stray Impact 0=Min., 1=Max.	All	1	1	1	1	1
46	"In-Sys." Loss per Stray	All	0.75	0.75	0.75	0.75	0.75
47	"In-System" Coho Spawners (In This Drainage)	Site 1	8,900	8,900	8,900	8,900	8,900
48	"In-System" Chinook Spawners (In This Drainage)	Site 1	7,600	7,600	7,600	7,600	7,600
49	"In-System" Coho Spawners (In This Drainage)	Site 2	20,900	20,900	20,900	20,900	20,900
50	"In-System" Chinook Spawners (In This Drainage)	Site 2	4,000	4,000	4,000	4,000	4,000
51	"In-System" Coho Spawners (In This Drainage)	Site 3	10,300	10,300	10,300	10,300	10,300
52	"In-System" Chinook Spawners (In This Drainage)	Site 3	1,900	1,900	1,900	1,900	1,900
53	"In-System" Coho Spawners (In This Drainage)	Site 4	0	0	0	0	0
54	"In-System" Chinook Spawners (In This Drainage)	Site 4	0	0	0	0	0
55	"In-System" Coho Losses due to Stray	Site 1	0	32	163	586	1,067
56	"In-System" Chinook Losses due to Stray	Site 1	0	81	170	426	793
57	"In-System" Coho Losses due to Stray	Site 2	0	32	163	586	1,067
58	"In-System" Chinook Losses due to Stray	Site 2	0	81	170	426	793
59	"In-System" Coho Losses due to Stray	Site 3	0	32	163	586	1,067
60	"In-System" Chinook Losses due to Stray	Site 3	0	81	170	426	793
61	"In-System" Coho Losses due to Stray	Site 4	0	0	0	0	0
62	"In-System" Chinook Losses due to Stray	Site 4	0	0	0	0	0
63	"Out-System" Strays	All	1.00%	1.00%	1.00%	1.00%	1.00%
64	"Out-System" Losses per Strays	All	50%	50%	50%	50%	50%
65	"Out-System" Coho Losses due to Stray	Site 1	0	5	27	98	178
66	"Out-System" Chinook Losses due to Stray	Site 1	0	13	28	71	132
67	"Out-System" Coho Losses due to Stray	Site 2	0	5	27	98	178
68	"Out-System" Chinook Losses due to Stray	Site 2	0	13	28	71	132
69	"Out-System" Coho Losses due to Stray	Site 3	0	5	27	98	178
70	"Out-System" Chinook Losses due to Stray	Site 3	0	13	28	71	132
71	"Out-System" Coho Losses due to Stray	Site 4	0	5	27	98	178
72	"Out-System" Chinook Losses due to Stray	Site 4	0	13	28	71	132
73	Estimated Coho Stray Losses (1000's)	All	.0	.1	.6	2.1	3.9

Economic Contrib.Table II

	A	B	C	D	E	F	G
74	Estimated Chinook Stray Losses (1000's)	All	.0	.3	.6	1.6	2.9
75	Baseline Coho "Natural" Harvest Contribution (1000's)		105.0	105.0	105.0	105.0	105.0
76	Baseline Chinook "Natural" Harvest Contribution (1000's)		135.0	135.0	135.0	135.0	135.0
77	Baseline "Other" Coho Harvest Contribution (1000's)		448.0	448.0	448.0	448.0	448.0
78	Baseline "Other" Chinook Harvest Contribution (1000's)		270.0	270.0	270.0	270.0	270.0
79	This Year Coho "Natural" Harvest Contribution (1000's)		105.0	105.0	105.0	105.0	105.0
80	This Year Chinook "Natural" Harvest Contribution (1000's)		135.0	135.0	135.0	135.0	135.0
81	This Year "Other" Coho Harvest Contribution (1000's)		448.0	448.0	448.0	448.0	448.0
82	This Year "Other" Chinook Harvest Contribution (1000's)		270.0	270.0	270.0	270.0	270.0
83	Adjusted "Natural" Coho Harvest Contribution	All	105.0	104.9	104.4	102.9	101.1
84	Adjusted "Natural" Chinook Harvest Contribution	All	135.0	134.7	134.4	133.4	132.1
85	"Total" Public Coho OPI Harvest Contrib. (1000's)	All	553.0	552.9	552.4	550.9	549.1
86	"Total" Public Chinook Harvest Contribution (1000's)	All	405.0	404.7	404.4	403.4	402.1
87	Release Site Coho Harvest Contribution (1000's)	Site 1	0	4	22	78	142
88	Release Site Chinook Harvest Oregon Contrib. (1000's)	Site 1	0	11	23	57	106
89	Release Site Coho Harvest Contribution (1000's)	Site 2	0	4	22	78	142
90	Release Site Chinook Harvest Oregon Contrib. (1000's)	Site 2	0	11	23	57	106
91	Release Site Coho Harvest Contribution (1000's)	Site 3	0	4	22	78	142
92	Release Site Chinook Harvest Oregon Contrib. (1000's)	Site 3	0	11	23	57	106
93	Release Site Coho Harvest Contribution (1000's)	Site 4	0	4	22	78	142
94	Release Site Chinook Harvest Oregon Contrib. (1000's)	Site 4	0	11	23	57	106
95	"Total" Release Site Coho OPI Harvest Contrib. (1000's)		0	17	87	312	569
96	"Total" Release Site Chinook Harvest Oregon Contrib. (1000's)		0	43	91	227	423
97	Publ.&Release Site Coho OPI Harvest Contrib. (1000's)		553	570	639	863	1118
98	Publ.&Release Site Coho Oregon Sport Contrib. (1000's)		165	167	172	191	212
99	Publ.&Release Site Coho Oregon Troll Contrib. (1000's)		235	244	278	387	512
100	Release Site Coho Troll Contribution (1000's)		0	7	38	140	260
101	Release Site Coho Troll Contribution (1000's)		235	236	240	247	251
102	Publ.&Release SiteChinook Oregon Harvest Contrib (1000's)		405	448	495	631	825
103	Publ.&Release Site Chinook Oregon Sport Contrib (1000's)		51	55	58	69	84
104	Publ.&Release SiteChinook Oregon Troll Contrib (1000's)		354	393	437	562	741
105	Release Site Chinook Oregon Troll Contrib (1000's)		0	38	80	202	380
106	Release Site Chinook Oregon Troll Contrib (1000's)		354	355	357	359	361
107	Total Sports Harvest in Oregon (Coho&Chin.)-(1000's)		217	222	231	260	296
108	Oregon Angler Days for Recreational Fishing		246249	246711	247624	250444	253961
109							
110	Ave. Weight Coho Returns to Release Site #'s Each		5.5	5.5	5.5	5.5	5.5
111	Ave. Weight Chinook Returns to Release Site #'s Each		10.1	10.1	10.1	10.1	10.1
112	Average Weight Troll Harvested Coho #'s Each		5.0	5.0	5.0	5.0	5.0
113	Average Weight Troll Harvested Chinook #'s Each		9.0	9.0	9.0	9.0	9.0
114							
115	Pounds of Coho Returning to Release Site(1000's)		0	24	120	429	782
116	Pounds of Chinook Returning to Release Site (1000's)		0	109	229	574	1,068
117	Pounds of Coho Harvested in Oregon (1000's)		1,177	1,219	1,388	1,935	2,559
118	Pounds of Chinook Harvested in Oregon (1000's)		3,182	3,538	3,930	5,055	6,673
119	Oregon Angler Days for Recreational Fishing		246,249	246,711	247,624	250,444	253,961
120							
121	Economic Value of Coho Returning to Release Site/#		$1.71	$1.71	$1.71	$1.71	$1.71
122	Economic Value of Chinook Returning to Release Site/#		$2.66	$2.66	$2.66	$2.66	$2.66
123	Economic Value of Coho Caught in Comm. Fishery/#		$3.46	$3.46	$3.46	$3.46	$3.46
124	Economic Value of Chinook Caught in Comm. Fishery/#		$5.77	$5.77	$5.77	$5.77	$5.77
125	Economic Value/Angler Day		$52	$52	$52	$52	$52
126							
127	Economic Value of Coho Returning to Release Site		$0	$40,630	$204,653	$734,342	$1,337,767
128	Economic Value of Chinook Returning to Release Site		$0	$290,024	$609,106	$1,525,559	$2,842,122
129	Economic Value of Coho Caught in Comm. Fishery		$4,072,714	$4,217,893	$4,603,984	$6,696,683	$8,852,854
130	Economic Value of Chinook Caught in Comm. Fishery		$18,358,034	$20,413,520	$22,674,952	$29,170,130	$38,501,009
131	Economic Value of Recreational Fishery		$12,804,971	$12,828,969	$12,876,433	$13,023,097	$13,205,990
132							
133							
134	Data from Above (ie 20% to release Site):						
135	Total Economic Value of Scenario ($Millions)		$35.2	$37.8	$41.2	$51.1	$64.7
136	Increased Economic Value Over Closure Scenario ($Millions)		$0.0	$2.6	$5.9	$15.9	$29.5
137							
138	Data from Above (ie 20% to release Site):						
139	Total Oregon Sport Coho & Chinook Harvest		216,831	221,540	230,854	259,634	295,524
140	Total Oregon Troll Coho & Chinook Harvest		588,932	636,906	714,331	948,812	1,253,128
141							
142	Data from "Economic Contribution Table" (ie 55% to release Site):						
143	Total Oregon Sport Coho & Chinook Harvest		216,831	221,547	230,827	259,628	295,538
144	Total Oregon Troll Coho & Chinook Harvest		588,932	636,955	714,152	948,747	1,253,245

Planting Master

Private Salmon Ranching Releases			Release	1000's	1000's	1000's	1000's	1000's	1000's	1000's	1000's	
		Specie	Permitted	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	
Operator	Site	Permitted	Millions	1972	1973	1974	1975	1976	1977	1978	1979	
Stricklin	Skipanon R.	Chum	5.0									
Nehelem Land n' Salmon	Nehelem Bay	Chum	5.0									
Harris & Hugle	Tillamook Bay	Chum	.1		8	10	9					
Keta, Inc.	Sand Creek	Chum	5.0	51	252	311	1,160		98	403	1,005	
Hampson (In Keta)	Sand Creek	Chum	5.0									
Oregon Aqua-Foods	Yaquina Bay	Chum	20.0		7	33	324	2	15	2	684	
Oregon Aqua-Foods	Yaquina Bay	Coho	9.5			88	142	1,171	1,376	8,898	3,894	
Oregon Aqua-Foods	Yaquina Bay	F.Chinook	10.6			27	18	148		393	141	
Oregon Aqua-Foods	Yaquina Bay	Sp.Chinook	InFallChin				6	161	42	16	887	
Oregon Aqua-Foods	Coos Bay	Chum	20.4								8,212	
Oregon Aqua-Foods	Coos Bay	Coho	11.3						86		242	
Oregon Aqua-Foods	Coos Bay	F.Chinook	9.4									
Oregon Aqua-Foods	Coos Bay	Sp.Chinook	InFallChin								313	
Ceratodus	Siuslaw River	Chum	5.0				500					
Domsea	Siuslaw Bay	Chum	25.0									
Domsea	Siuslaw Bay	Coho	12.0							400	738	
Domsea	Siuslaw Bay	F.Chinook	12.0								62	
Siuslaw Fisheries	Siuslaw River	Chum	5.0		10	221	800		6	66	1,038	
Anadromous, Inc.	Coos Bay	Chum	20.5									
Anadromous, Inc.	Coos Bay	Coho	11.3					909	908	610	937	
Anadromous, Inc.	Coos Bay	F.Chinook	9.4				991			129	19	
Anadromous, Inc.	Coos Bay	Sp.Chinook	InFallChin								198	
Heckard	Coos Bay	Chum	5.0									
Oregon-Pacific	Burnt Hill Cr.	F.Chinook	5.0									
Oregon-Pacific	Burnt Hill Cr.	Sp.Chinook	InFallChin									
Total Annual Planting			Chum	51	269	565	2,784	2	121	465	10,940	
			Coho	0	0	88	142	2,080	2,370	9,908	5,811	
			F.Chin	0	0	27	1,009	148	0	522	222	
			Sp.Chin	0	0	0	6	161	42	16	1,398	
Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	

Planting Master

Private Salmon Ranching Releases			Release	1000's	1000's	1000's	1000's	1000's	1000's	1000's	1000's	1000's
		Specie	Permitted	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd	Plant'd
Operator	Site	Permitted	Millions	1980	1981	1982	1983	1984	1985	1986	1987	1988
Stricklin	Skipanon R.	Chum	5.0									
Nehelem Land n' Salmon	Nehelem Bay	Chum	5.0		650	578	893	118	275	394	208	200
Harris & Hugle	Tillamook Bay	Chum	.1									
Keta, Inc.	Sand Creek	Chum	5.0		1,413	770	1,190	75	150	250	125	
Hampson (In Keta)	Sand Creek	Chum	5.0									
Oregon Aqua-Foods	Yaquina Bay	Chum	20.0		3,180	244	2,958	1,136	289	914	200	
Oregon Aqua-Foods	Yaquina Bay	Coho	9.5	7,585	11,925	20,589	14,889	8,647	4,337	5,584	4,092	4,000
Oregon Aqua-Foods	Yaquina Bay	F.Chinook	10.6	152	249	338	861	520	957	950		
Oregon Aqua-Foods	Yaquina Bay	Sp.Chinook	InFallChin		89		55	354	312		4,488	4,000
Oregon Aqua-Foods	Coos Bay	Chum	20.4									
Oregon Aqua-Foods	Coos Bay	Coho	11.3	5,446	10,870	803		2,272				
Oregon Aqua-Foods	Coos Bay	F.Chinook	9.4		43							
Oregon Aqua-Foods	Coos Bay	Sp.Chinook	InFallChin		112							
Ceratodus	Siuslaw River	Chum	5.0									
Domsea	Siuslaw Bay	Chum	25.0		176	58	212					
Domsea	Siuslaw Bay	Coho	12.0	241	158	61	47					
Domsea	Siuslaw Bay	F. Chinook	12.0	91	34	74	22					
Siuslaw Fisheries	Siuslaw River	Chum	5.0	8	110							
Anadromous, Inc.	Coos Bay	Chum	20.5									
Anadromous, Inc.	Coos Bay	Coho	11.3	1,546	899	1,655	1,341		4,249	3,071	477	1,200
Anadromous, Inc.	Coos Bay	F. Chinook	9.4	96	174	159	311	815	1,039	100		
Anadromous, Inc.	Coos Bay	Sp.Chinook	InFallChin	623	616	93	924	1,159	427	598	5,323	1,075
Heckard	Coos Bay	Chum	5.0				350	140	4		22	
Oregon-Pacific	Burnt Hill Cr.	F.Chinook	5.0	99		59						
Oregon-Pacific	Burnt Hill Cr.	Sp.Chinook	InFallChin	635	939	258	1,006	194	18	454	879	866
Total Annual Planting			Chum	8	5,529	1,650	5,603	1,469	718	1,558	555	200
			Coho	14,618	23,852	23,108	16,277	10,919	8,586	8,655	4,569	5,200
			F.Chin	438	500	630	1,194	1,335	1,996	1,050	0	0
			Sp.Chin	1,258	1,756	351	1,985	1,707	757	1,052	10,490	5,941
Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 2	Note 3
Note 1-All data these columns based on "Private Salmon Hatcheries in Oregon, 1986" by T. Edwin Cummings, Fish Division, ODFW, Sept., 1987.												
Note 2-All data in this column based on preliminary data from T.Edwin Cummings, ODFW.												
Note 3-All data this column based on production release plans submitted to ODFW, except Nehelem Land n' Salmon. (Chum sites typically file no plan.)												

Returns Master

Smolts Planted (1000's) - Source: Planting Master Table:																	
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Chum	51	269	565	2,784	2	121	465	10,940	8	5,529	1,650	5,603	1,469	718	1,558	555	200
Coho	0	0	88	142	2,080	2,370	9,908	5,811	14,818	23,852	23,108	16,277	10,919	8,586	8,655	4,569	5,200
F.Chin	0	0	27	1,009	148	0	522	222	438	500	630	1,194	1,335	1,996	1,050	0	0
Sp.Chin	0	0	0	6	161	42	16	1,398	1,258	1,756	351	1,985	1,707	757	1,052	10,490	5,941
Chinook	0	0	27	1,015	309	42	538	1,620	1,696	2,256	981	3,179	3,042	2,753	2,102	10,490	5,941
Salmon Return to Release Sites (Numbers)-Note 1:							1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
Chin.A	(ie, Over 24")						213	271	752	2588	7644	5117	3571	9288	62627	37109	
Chin.J	(ie, Under 24")						31	145	2642	2499	4439	974	2728	25387	8157	2158	
All Chinook							244	416	3394	5087	12083	6091	6299	34675	70784	39267	
Chum							539	14	545	477	1132	515	821	3220	769	323	
Coho A	(ie, Over 20")						8069	47726	27745	98681	165034	127845	84501	288488	445103	118603	
Coho J	(ie, Under 20")						6557	1445	15639	19098	19687	6098	30902	43564	8641	1424	
						Total	15409	49601	47323	123343	197936	140549	122523	369947	525297	159617	
Salmon Return to Release Sites (Pounds)-Note 1:							1978	1979	1980	1981	1982	1983	1984	1985	1986	1986	
Chin.A	(ie, Over 24")						3952	2872	9386	35860	87654	54441	55196	118929	747989	497321	
Chin.J	(ie, Under 24")						23	519	7179	6046	13657	2052	6206	113878	29558	7998	
All Chinook							3975	3391	16565	41906	101311	56493	63404	232807	777547	505319	
Chum							4841	110	4815	4053	9133	3961	7561	21470	6796	2661	
Coho A	(ie, Over 20")						38903	225105	145614	631619	932886	504685	458235	1631704	2345616	646336	
Coho J	(ie, Under 20")						15736	2224	31922	42070	48356	10210	89363	101986	15328	3326	
						Total	63455	230830	198916	719648	1091686	575349	616563	1987967	3145287	1157641	
Salmon Return to Release Sites (Pounds/Each)-Note							1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
Chin.A	(ie, Over 24")						18.6	10.6	12.5	13.9	11.5	10.6	15.5	12.8	11.9	13.4	
Chin.J	(ie, Under 24")						.7	3.6	2.7	2.4	3.1	2.1	3.0	4.5	3.6	3.7	
All Chinook							16.3	8.2	4.9	8.2	8.4	9.3	10.1	6.7	11.0	12.9	
Chum							9.0	7.9	8.8	8.5	8.1	7.7	9.2	6.7	8.8	8.2	
Coho A	(ie, Over 20")						4.8	4.7	5.2	6.4	5.7	3.9	5.4	5.7	5.3	5.4	
Coho J	(ie, Under 20")						2.4	1.5	2.0	2.2	2.5	1.7	2.9	2.3	1.8	2.3	
Note 1-All Return data thru 1986 based on "Private Salmon Hatcheries in Oregon, 1986" by T. Edwin Cummings, Fish Division, ODFW, Sept., 1987.																	
All data for 1987 based on preliminary data from T.Edwin Cummings, ODFW.																	